THE FISHES
OF THE
INDO-AUSTRALIAN ARCHIPELAGO

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THE FISHES
OF THE
INDO-AUSTRALIAN ARCHIPELAGO

IX

PERCOMORPHI (CONCLUDED), BLENNOIDEA

with 89 illustrations

BY

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and with the collaboration of

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INTRODUCTION

The text of this volume, the ninth of the series, has been written during the war, in the years 1941-1944, but printing has been delayed as it was impossible to do so during the later periods of the war and as after the war the presses of the publishing and printing firm E. J. Brill Ltd. of Leiden were either damaged or so crammed with other urgent work, that it is only now that this volume can be published.

In the meantime much in the world has changed. The sovereignty of that part of the Indo-Australian archipelago which formed the Dutch East Indias, now has passed into the hands of the Republik Indonesia, and I am very grateful to its Government for having decided to promote the issue of this work in the same way as up to now has been done by the Dutch Government.

Another change, which concerns me personally, is that I, having reached the age limit, had to retire as Professor and as Director of the Zoological Museum of Amsterdam. I have to thank the Netherlands Organisation for Pure Research (Z.W.O.) for enabling me through finantial support to continue the work on the fishes of the Indo-Australian archipelago, and Dr. H. Engel, my successor as Professor and Director of the Zoological Museum, for giving me the loan of those fish collections which I have to study and to describe for the forthcoming volumes.

The present volume contains the concluding part of the order Percomorphi and the entire order Blennoidea. Among this last order the genus *Salarias s.l.* is a notorious difficult one. I studied the material available to me in the Netherlands, but, of course, visits to London and Paris to see the many types in the British Museum and the Museum National d'Histoire Naturelle were impracticable during the war. So I was well aware that, although I had succeeded in bringing some order in the chaos, the results still were deficient. After the war, however, I came in contact with Professor W. M. Chapman, School of Fisheries, University of Washington, who at that time was specializing in the study of *Salarias s.l.* and who had the opportunity to visit the principal museums of America as well as of Europe. Professor Chapman kindly accepted my suggestion that he should write the account of *Salarias* and related genera for this volume. As a consequence this part of the volume is far superior to what I could have written and I am very thankful to Professor CHAPMAN for having given this work priority over other urgent activities. In a footnote on p. 243 is mentioned which part of the book is his work. I need not give here the information about the way in which measurements have been taken, as this has been done in the introduction of each of the previous volumes.

Most of the figures in this volume again have been drawn by the able hand of Mr. J. F. OBBES, but a number had to be copied from other works.

De Hooge Kley, Amersfoort L. F. DE BEAUFORT

May, 1951

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Order PERCOMORPHI (continued)

I. Suborder **Percoidea** (continued)

5. Division CHIASMODONTIFORMES

Body compressed, elongate, covered with small granular ctenoid scales, or naked. Lateral line complete, single or double, continuous. Spinous dorsal consisting of stiff or flexible spines, much shorter than second dorsal. Anal long with one spine or without spines. Ventrals below or before pectorals, with or without a distinct spine and 5 rays. Cleft of mouth very large, premaxillaries and maxillaries long, the latter exposed. Pseudobranchiae present or absent. Preopercle generally with one or more spines at its angle, its hind-border and lower border may also have spines or fine denticulations. Sensory canals of skull generally well developed; as a rule a pair of ridges on the interorbital space, often prolonged forwards on snout and backwards on occiput. Teeth in the jaws long, slender, and depressible, mixed or not with small villiform ones. Teeth on vomer, or on palatines, or palate edentulous.

Note. At the time Weber and I wrote the account of the Percesoces in Vol. IV of this series, we had to decide, if we should follow Boulenger (Cambridge Series, Fishes, 1904, p. 641) who united *Chiasmodon, Pseudoscopelus* and *Champsodon* in one family of the Percesoces or follow Tate Regan (Proc. Zool. Congress Boston (1907), 1910, p. 10) who found in the skeleton of *Champsodon* indications of relationship with the Parapercidae, whereas he expressed the opinion that *Chiasmodon* and *Pseudoscopelus* are related to the Scopelidae. In 1913 Regan (Ann. Mag. Nat. Hist. (8) XII, p. 137) placed *Champsodon* in the family Champsodontidae, Division Champsodontiformes of the Suborder Percoidea, Order Percomorphi.

We decided not to follow Boulenger and therefore ommitted the Chiasmodontidae from the Percesoces, as we were convinced that Regan was right in placing *Champsodon* among the Percomorphi. According to our opinion Regan failed to prove the relation of *Chiasmodon* and *Pseudoscopelus* to the Scopelidae, and as we likewise could not agree with Günther (Cat. Fish. Br. Mus. V, 1864, p. 435) who placed *Chiasmodon* among the Gadidae, we decided to treat the families Champsodontidae and Chiasmodontidae as members of the Percoidea, leaving it undecided if we should unite them into one division or not.

Since then Norman (Ann. Mag. Nat. Hist. (10) III, 1929, p. 529) wrote an account of the Chiasmodontidae, including the genera *Chiasmodon, Dysalotus, Pseudoscopelus,* and *Odontonema.* He proved that this family belongs to the Percomorphi as defined by Regan and that there is "no valid reason for excluding them from his suborder Percoidea". However the study of the osteology of *Chiasmodon* convinced Norman that the Champsodontidae and the Chiasmodontidae cannot be related.

Although I admit that the resemblance of the Chiasmodontidae, and especially of *Pseudoscopelus* to *Champsodon* may be due to convergence as a result of a probable similar mode of life, I have united here the Champsodontiformes of Regan and the Chiasmodontiformes of Norman into one division, in order not to multiply unnecessarily the large number of divisions of the Percoidea.

Key to the Indo-Australian families of Chiasmodontiformes

A. Body covered with small granular scales. Two lateral lines. Teeth on vomer, none on palatines. 1. *Champsodontidae* p. 2.

B. Body naked. One lateral line. No teeth on vomer; teeth on palatines present or absent . 2. *Chiasmodontidae* p. 5.

1. Family CHAMPSODONTIDAE

Elongate, compressed, head and body covered with small granular scales. Mouth very large, jaws with long villiform teeth and long depressible canines. Vomer toothed, palatines without teeth. Two lateral lines, with transverse branches. Two dorsals, the first short and consisting of spines, the second with one spine and many rays, and about as long as the long anal. Ventrals inserted before pectorals, with a spine and five rays. Pectorals short. Pseudobranchiae present.

Distribution that of the single genus known.

1. **Champsodon** Günther

(Günther, Proc. Zool. Soc. London 1867, p. 102)

Body elongate, compressed, covered with minute granular ctenoid scales. Head scaly. Two indistinct lateral lines, with transverse branches. Mouth oblique, maxillary exposed. Villiform bands of teeth in the jaws and a row of longer, depressible, slender, needle like teeth. Two patches of small teeth on vomer. Hindborder of preopercle finely denticulated. A long dagger like spine at its angle, directed backwards, and sometimes smaller spines along its lower border. Two spines on lower border of preorbital. Two dorsals, the first consisting of IV-V slender spines, the second with 1 spine and 18-20 rays. Anal with 1 spine and 17-18 rays. Base of short pectoral oblique. Ventrals inserted well before pectorals, rather long. Caudal forked. Seven branchiostegals. Gillopenings very wide.

Distribution. Indic and Pacific, apparently living on the bottom of shallow and moderate deep seas.

Key to the Indo-Australian species of Champsodon

1. A knob at symphysis of upper jaw, between two notches of premaxillaries. Maxillary reaching beyond vertical through hindborder of eye . . 1. *Ch. capensis* p. 3.
2. No knob at symphysis, premaxillaries without notches. Maxillary reaching to below hindborder of eye . . . . 2. *Ch. guentheri* p. 4.

1. **Champsodon capensis** Regan (Fig. 1, p. 3)

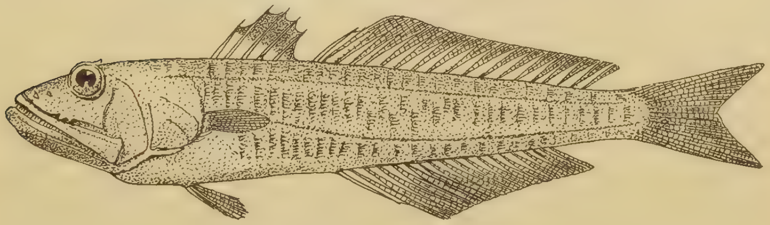

Fig. 1. *Champsodon capensis* Regan. × 4/3.

Champsodon vorax Günther, Challenger Exp. Rep. Zool. VI. 1880, p. 43 (nec Gthr).

Champsodon vorax Alcock, Journ. Asiat. Soc. Bengal LVIII, 1889, p. 302 — Descr. Cat. Indian Deep-Sea Fishes, 1899. p. 47. — Ill. Zool. Investigator, Fishes, 1900, Pl. XXVIII, fig. 5.

Champsodon capensis Tate Regan, Trans. Linn. Soc. London XII, Part 3, 1908, p. 244.

Champsodon arafurensis Tate Regan, ibid. p. 245.

Champsodon arafurensis M. Weber, Siboga Exp. Fische, 1913, p. 146.

Champsodon capensis Barnard, Ann. S. Afric. Mus. XXI, Part II, 1927, p. 432.

Champsodon capensis Norman, Sc. Reports John Murray Exp. Brit. Mus. VII, No. 1, 1939, p. 66.

Champsodon curtipes Fowler, Bull. U. S. Nat. Mus. 100. Vol. 14. part 2. 1943. p. 83.

D^1. V. D^2. I. 18-19. A. I. 18. P. 9-10. V. I. 5. Sq. l. about 110. Ltr. about 40.

Height 5.1-5.4, 6.3-6.5 in length with caudal. Head 3.3, 4 in length with caudal. Eye 4.5-4.6, 1.1 in snout. Interorbital space flat, 1.5-2 in eye. A pair of parallel ridges from snout along interorbital space to occiput, where they are wider apart; then diverging and ending in a supraclavicular spine. Two diverging spines on the lower border of the preorbital and a dagger like spine at the angle of the preopercle, directed backwards, and as long as eye. A knob at symphysis of upper jaw, between two notches of the premaxillaries. Mouth very large, oblique, maxillary reaching beyond vertical through hindborder of eye. A narrow row of villiform teeth and a row of distant long and slender depressible teeth in the jaws, those of the lower jaw longer than those of the upper jaw. Two small fleshy tentacles on superior part of eye. Head covered with small granular scales. Distance between origins of first and second dorsals 2.4-2.7 in distance between tip of snout and origin of first dorsal. Origin of anal midway between tip of snout and base of caudal. End of anal below end of second dorsal. Pectorals equal to postorbital part of head. Ventrals with the 3rd and the 4th rays longest, equal to head without snout. Caudal deeply forked, the lobes pointed. Colour of preserved specimens brownish. Underside and sides of head silvery. Fins hyaline, first dorsal sometimes dusky at tip. Length 133 mm.

Habitat: Madura Strait, 56 M!; Madura Sea, 100 M!; Bay of Bima, 55 M; Strait Buton, 39-94 M!; Timor Sea, 8-36 M!; near Waigeu, 141 M; Arafura Sea, near Kei Islands, 232 M. — South Coast of Cape Colony, 54-63 M, False Bay, Agulhas Bank to Natal, 25-432 M, Zanzibar area, 183-457 M, Bay of Bengal, 72-180 M, off the Malabar Coast, 50-223 M, several stations in the sea near the Philippines, 23-175 M.

2. **Champsodon guentheri** Regan (Fig. 2, p. 5)

Champsodon vorax Günther, Challenger Exp. Rep. Zool. VI, 1880, p. 52, p. 56 (nec Gthr).
Champsodon guentheri Tate Regan, Trans. Linn. Soc. London XII, Part 3, 1908, p. 244.
Champsodon Guentheri M. Weber, Siboga Exp. Fische, 1913, p. 146.

D^1. V. D^2. 1.20. A. 1.17. P. 10. V. 1.5. Ll. about 145. Ltr. about 55.

Height 5.8-6.3, 6.7-7.6 in length with caudal. Head 3.2-3.3, 3.8-4 in length with caudal. Eye 4.7-4.8, 1.3-1.4 in snout. Interorbital space flat, 2.2-2.7 in eye. A pair of parallel ridges from snout along interorbital space to occiput, interrupted before eyes, slightly converging on interorbital space, rapidly diverging behind eyes and again parallel on occiput, interrupted above hindborder of preopercle, then diverging again and ending in a suprascapular spine. Two diverging spines on the lower border of the preorbital. A dagger like spine at angle of preopercle, directed backwards and as long as or slightly shorter than eye. Two short spines on the lower border of the preopercle, directed downwards. Mouth very large, oblique, maxillary reaching to below posterior border of eye. No knob at symphysis and premaxillaries not notched. A narrow row of villiform teeth and a row of distant slender teeth in the jaws, those of the lower jaw slightly the longer. A small fleshy tentacle on superior part of eye. Head covered with small granular scales, opercle almost naked. Distance between origins of dorsals 2.2 in distance between tip of snout and origing of first dorsal. Origin of anal slightly nearer base of caudal than to tip of snout. End of anal below or slightly behind end of second dorsal. Pectorals as long as snout and half eye. Ventrals with the third ray longest, half length of snout shorter than head. Caudal forked. Colour of preserved specimens brownish, below and sides of head silvery. Fins whitish or hyaline. Length 140 mm.

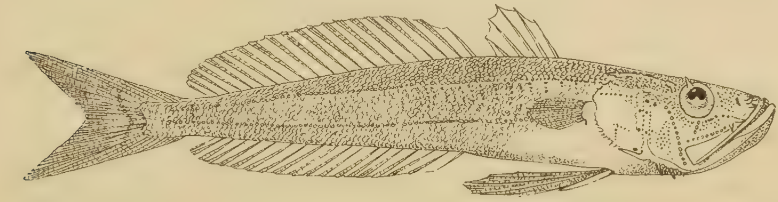

Fig. 2. *Champsodon guentheri* Regan. × $1^1/_2$.

Habitat: Arafura Sea, 238 M! — Philippines, 207 M, Admirality Islands. In sea, on sandy bottom.

2. Family CHIASMODONTIDAE

Elongate, compressed, without scales. Mouth very large, with long depressible teeth in the jaws. No teeth on vomer. Teeth on palatines present or absent. Lateral line uninterrupted. Two dorsals, the first much shorter than the second, which is about as long as anal. Ventrals inserted below or before pectorals, which are rather long and narrow. Pseudobranchiae present or absent. Gill-openings very wide, the membranes narrowly connected with the isthmus anteriorly; four gills.

Distribution: Deep Sea fishes from the Atlantic, Indic, and Pacific.

Key to the genera of Chiasmodontidae

I. Palatine teeth present.
  A. Small mucous pores aggregated into difinite rows, appearing as dark streaks on head and body. Palatine teeth in two or three series . . . . 1. *Pseudoscopelus* p. 6.
  B. No definite rows of mucous pores. Palatine teeth in a single row . . . . 2. *Chiasmodon* p. 9.
II. Palatine teeth absent . . . . 3. *Odontonema* p. 10.

1. **Pseudoscopelus** Lütken

(Lütken, Mém. Acad. Royale Sc. Danemark (6) VII, N° 6, 1892, p. 285)

Body elongate, compressed, tapering posteriorly, naked. Rows of small mucous pores, appearing as dark streaks on head along upper and lower jaw, and on median line of belly, bifurcating at anus and encircling the anal fin. Cleft of mouth very wide, maxillary reaching far behind eye. Teeth slender and acutely pointed; in each jaw an outer series of small erect teeth, and in one to five series of larger depressible teeth inwards, those of the inner row longest. Palatines with more than one row of teeth of varying size and similar to those of the jaws. First dorsal with VIII spines, second dorsal with 22-25 rays. Anal with 20-25 rays. Pectorals pointed, moderate or rather long. Ventrals inserted before or slightly behind pectoral base. Caudal forked.

Distribution: Atlantic, Pacific, and Seas of Indo-Australian Archipelago, the few species living at moderate or great depth.

Key to the Indo-Australian species of Pseudoscopelus

1. Lower front outer teeth very short, curved flare outward (*Myersiscus*) . . . . 1. *P. obtusifrons* p. 6.
2. Lower front outer teeth do not flare outward.
  a. Snout more pointed, $3^{3}/_{4}$ in head. Head 3 . 2. *P. cephalus* p. 7.
  b. Snout more obtuse, 4 in head. Head $3^{1}/_{2}$. 3. *P. microps* p. 8.

1. **Pseudoscopelus obtusifrons** (Fowler)

Myersiscus obtusifrons Fowler, Proc. Acad. Sc. Philadelphia LXXXV, 1934, p. 362.

"Depth $3^3/_5$; head $3^1/_4$, width $1^3/_4$. Snout $4^1/_{10}$ in head; eye 5, $1^1/_5$ in snout, 2 in interorbital; maxillary extends about eye diameter beyond eye, very oblique, length $1^3/_5$ in head; upper teeth in 2 series, short in outer row, curved, innermost anteriorly especially longest; lower teeth biserial, outer small and at front of mandible (about 8) flare outward, innermost greatly longer; row of rather long teeth on each palatine, all somewhat shorter than inner upper jaw series; interorbital $2^1/_2$, rather high, convex. Gill rakers about 18 lower, very short, close-set spinules, barely $^1/_5$ of gill filaments, which $^7/_8$ of eye.

No scales. Lateral line with 71 pores. Granular papillae as in *Pseudoscopelus*. D. VIII-1, 21, third spine 2 in head, first branched ray $1^1/_6$; A. 1, 19, first branched ray $1^1/_2$; caudal $1^1/_5$, forked; least depth of caudal peduncle $3^7/_8$; pectoral $1^1/_4$, rays 1,11; ventral 1,5, fin $2^1/_5$ in head.

Largely brown, darker below. Iris dark gray. Fins pale." After Fowler, not seen by me. Length 115 mm.

Habitat: Gulf of Boni, Celebes, 918 M.

2. **Pseudoscopelus cephalus** Fowler (Fig. 3, p. 7)

Pseudoscopelus cephalus Fowler, Proc. Acad. Sc. Philadelphia LXXXV, 1934, p. 361.

Pseudoscopelus cephalus? Norman, Sc. Rep. John Murray Exp. Brit. Mus. VII. N° 1, 1939, p. 71.

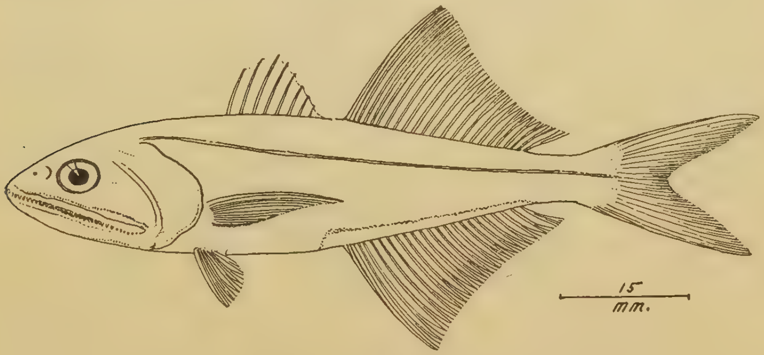

Fig. 3. *Pseudoscopelus cephalus Fowler*. After Fowler.

"Depth $4^1/_2$; head 3, width 2. Snout $3^3/_4$ in head; eye $4^2/_3$, $1^1/_4$ in snout, $1^2/_3$ in interorbital; maxillary reaches $1^1/_3$ eye diameters beyond eye, length $1^1/_3$ in head; mouth more or less completely closing; upper teeth small, in 3 or 4 irregular series, inner largest; lower teeth with irregular outer series of very small short teeth and 11 clusters of 6 or 7 inner teeth gradually largest to innermost; palatine teeth like upper teeth, only innermost largest; interorbital $3^{3}/_{4}$ in head, convex, low; small spine at lower hind preopercle end. Gill rakers about 18 lower very minute short points, barely $^{1}/_{5}$ gill filaments, which $1^{1}/_{2}$ in eye. No scales. Lateral line (damaged) with possibly 60? pores. Papillae as in microps D. VIII-11, 21, first branched ray $1^{1}/_{4}$ in head; A. ii, 21, first branched ray $1^{2}/_{5}$; caudal $1^{1}/_{8}$, forked; least depth of caudal peduncle $4^{1}/_{4}$; pectoral $1^{2}/_{5}$?, rays i, 12; ventral i, 5, fin 3 in head.

Faded largely pale brown, with darker or apparently blackish pigment below. Iris neutral gray. Fins pale." After Fowler, not seen by me. Length 89 mm.

Habitat: Sulu Sea, 914 M. — Arabian Sea?

3. **Pseudoscopelus microps** Fowler (Fig. 4, p. 8)

Pseudoscopelus microps Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXV, 1934, p. 359.

"Depth $4^{1}/_{4}$; head $3^{1}/_{2}$, width $2^{1}/_{10}$. Snout 4 in head; eye $7^{1}/_{3}$, 2 in snout, $2^{1}/_{2}$ in interorbital; jaws about even; maxillary extends 2 eye diameters beyond eye, length $1^{1}/_{3}$ in head; small spine at lower hind end of preopercle; upper teeth in 4 series, innermost much longest, same below, except teeth in about 11 clusters on each ramus; palatines with long row of teeth simlar to those of upper jaw only innermost still longer; interorbital 3, convex. About 2 + 14

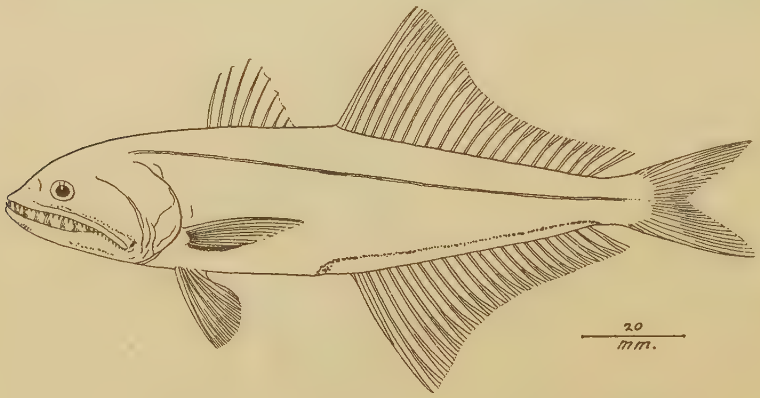

Fig. 4. *Pseudoscopelus microps Fowler.* After Fowler.

short irregular simple spinescent gill rakers, barely $^1/_4$ gill filaments, which $^4/_5$ of eye. No scales. Lateral line with 74 pores. Head with large scattered pores. Irregular row of small dark papillae along upper edge of maxillary and lower face of each mandibular ramus, down breast and belly medially and about inner basal parts of ventral rays, also along lower edge of pectoral fin and lower edge of caudal peduncle, especially before lower rudimentary caudal rays. D. VIII-ii, 21, first branched ray $1^1/_4$ in head; A. iii, 21, first branched ray $1^1/_4$; caudal $1^1/_4$, forked; least depth of caudal peduncle $3^3/_4$; pectoral $1^2/_5$, rays i, 10; ventral i, 5, fin $1^7/_8$ in head. Brown. Lower region of opercles, branchiostegals, belly and sides of abdomen, blackish with blue tinge. Inside gill opening blackish brown. Iris dark neutral gray. Fins pale brownish." After Fowler, not seen by me. Length 143 mm.

Habitat: Gulf of Boni, Celebes, 1260 M.

2. **Chiasmodon** Johnson

(Johnson, Proc. Zool. Soc. London 1863, p. 408)

Chiasmodus Günther, Cat. Brit. Mus. V, 1864, p. 435.

Body elongate, compressed, and tapering posteriorly, naked without definite rows of mucous pores. Belly pendent, its walls menbranaceous. Nostrils in the middle of the snout. Cleft of mouth extremely wide, maxillary reaching far behind eye. Long and slender distant depressible canines in the jaws; palatines with short fixed teeth. Preopecle with few blunt short spines along the lower part of its hindborder. First dorsal with X flexible spines, the second with 24-29 rays. Anal with 27-29 rays. Pectorals rather long. Ventrals inserted below pectorals, with 5-6 rays. Caudal forked. Gillmenbranes free. Gillopening wide. Pseudobranchiae present or absent.

Distribution: Deep Sea fishes from the Indic and Atlantic.

1. **Chiasmodon braueri** M. Web. (Fig. 5, p. 10)

Chiasmodon niger Brauer, Wiss. Erg. Valdivia XV. Tiefsee-Fische, 1906, p. 254 (nec Johnson).
Chiasmodon Braueri M. Weber, Siboga Exp. Fische, 1913, p. 147.
Chiasmodon braueri Norman, Ann. Mag. Nat. Hist. (10) III, 1929, p. 540.

B. 6. D^1. X. D^2. 24-27. A. 27. P. 9. V. 6.

Height about 7. Head 4-4.5. Snout 3-4, eye 5-5.5 in head, slightly less than interorbital space. Pectorals as long as head. About 30 teeth in the premaxillary, and about 20 in the lower jaw. A row of larger, depressible teeth of about 5-6 in the upper jaw and 7-8 in the lower jaw. In both jaws the second tooth is the longest. A row of 8-9 small equal teeth on each palatine. A pair of divergent ridges on interorbital space. Colour of preserved specimen brown. Length 56 mm.

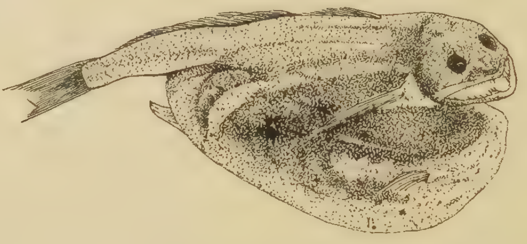

Fig. 5. *Chiasmodon braueri* M. Web.

Habitat: Banda Sea, 1886 M! — Atlantic, Coast of Siera Leone, 3070 M.

Note. This species differs from the other species of the genus in having but 9 pectoral rays.

3. **Odontonema** M. Weber

(M. Weber, Siboga Exp. Fische, 1913, p. 148)

Elongate, compressed, tapering posteriorly, naked. Lateral line indicated by distant pores. Nostrils in the middle of the snout. Cleft of mouth very wide, lower jaw longer than upper one. Jaws with an inner row of few, long, teeth, directed forwards, but depressible and covered by a mucous membrane, and an outer row of longer and shorter, extremely slender naked teeth. No teeth on palate. Opercular apparatus reduced. No spine at angle of preopercle. No pseudobranchiae. Three gillarches, no split behind the last. Two dorsals, the second as long as the anal and much longer than the first dorsal. Ventrals short, with 6 rays, inserted before the pectorals, which are long and narrow. Seven branchiostegals.

Distribution: That of the single species known.

1. **Odontonema kerberti** M. Web.

Odontonema Kerberti M. Weber. Siboga Exp. Fische, 1913, p. 149.

D^1. 11. D^2. 24. A. 25. P. 9. V. 6.

Head conical, 3. Eye 6, about twice in snout, and 1.3 in interorbital space. A pair of ridges, divergent behind, on interorbital space, which is concave. Head with several grooves, closed by membranes. Cleft of mouth almost reaching to below opercle. Four almost straight slender teeth in the inner row and five setiform teeth in the outer row. Dorsal rays almost as long as head without snout. Anal rays somewhat shorter. Pectorals slightly shorter than head. Colour brown. Length of single specimen 80 mm.

Habitat: Banda Sea, 1886 M!

6. Division TRACHINIFORMES

Body compressed or somewhat depressed, covered with small or large scales, or naked. Lateral line single, complete, exceptionally ending near middle of body, running along the middle of the sides or high along the back. Dorsal and anal long, the former with a spinous part anteriorly, which may be separated as a distinct fin or wanting. Ventrals below or before pectorals, with a spine and five rays, the middle or inner rays longest. Cleft of mouth not very large, horizontal, oblique or even vertical. Pseudobranchiae present. Opercular bones armed with spines and denticulations or not. Teeth in the jaws generally in villiform bands, often mixed with larger ones or with canines. Teeth on vomer generally present. Teeth on palatines present or absent.

Key to the Indo-Australian families of Trachiniformes

A. Lateral line complete, running along the middle of the sides.
  a. Scales small. Preorbital without spine.
    a'. Body elongate. Dorsal with a few spines anteriorly . . . . 1. *Pinguipedidae* p. 11.
    b'. Body much elongate. Anterior dorsal rays unarticulated, but not spinous . . . . 2. *Trichonotidae* p. 29.
  b. Scales large. Preorbital with a spine. A short spinous dorsal present or absent . . . . 3. *Hemerocoetidae* p. 31.
B. Lateral line running high.
  a. Mouth nearly horizontal. Maxillary broad and long, reaching far behind eye. Lateral line ending near middle of dorsal fin . . . 4. *Opisthognathidae* p. 34.
  b. Mouth vertical, the lower jaw prominent. Eyes superior. Lateral line complete . . . 5. *Uranoscopidae* p. 40.

1. Family PINGUIPEDIDAE

Body elongate, covered with ctenoid or cycloid scales. Head partly scaly. Lateral line single, complete, running along sides. One long dorsal with a few spines anteriorly. Anal long with or without spines anteriorly. Ventrals below or somewhat in advance of the pectorals, fairly wide apart, each of a spine and 5 branched rays, without scaly axillary process. Eyes lateral or somewhat superior. Mouth protractile, terminal, slightly oblique. Maxillary concealed, without supramaxillary. Teeth in jaws generally in villiform bands, with larger caninoid or canines. Teeth on vomer present, on palatines present or absent. Two nostrils on each side. Gillmembranes united, free from the isthmus, 6 branchiostegals, 4 gills. Pseudobranchiae present.

Distribution: A few genera from tropical and subtropical parts of West Atlantic, Indic, and Pacific.

1. **Parapercis** Bleeker

(Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 236)

Percis Bloch Schneider Syst. Ichth. 1801, p. 179 (nec Scopoli).
Neopercis Steindachner, Denkschr. Akad. Wien XLIX, 1884, p. 212.

Elongate, body cylindrical. Head somewhat depressed. Snout naked, opercular bones and upper part of head behind eyes scaly. Scales small, ctenoid, those of head, breast and belly often cycloid. Lips thick. Teeth in jaws in villiform bands, with an outer series of enlarged ones, sometimes canines. Teeth on vomer in a few rows, on palatines in one or two rows or absent. Dorsal with IV-V spines and 19-23 rays, the soft portion much higher than the spinous one. Anal similar to, but shorter than soft dorsal, with or without a feeble spine and 16-21 rays. Ventrals with a short spine, hidden in the skin, and 5 rays, the fourth much longer than the others; situated below or slightly in advance of pectorals. Caudal truncate or slightly rounded.

Distribution: Red Sea, tropical and subtropical coasts of Indic and Pacific. Some species benthonic.

Note. Up to Bleeker the name *Percis* has been used for this genus. Bleeker first introduced the name *Parapercis* in a list of fishes from Ternate (Ned. Tijdschr. Dierk. I, 1863, p. 236) without giving the reason why. He simply says: "Parapercis cylindrica Blkr = Percis cylindrica C. V.". M. Weber (Siboga Exp. Fische 1913, p. 518, footnote) supposes that he changed the name on account of Klein's *Percis* 1749 = *Acerina* Cuv. as Bleeker says in his Systema Percarum revisum (Arch. Neerl. Sc. Nat. XI, 1876, p. 266): "*Percis* Klein (1749) nec Bl. Schn. = *Acerina* Cuv.".

The name of Klein, however, is not binominal and *Percis*

Bl. Schn. would be valid, if Scopoli (Introductio ad Historiam Naturalem 1777, p. 454) had not introduced the name *Percis* for *Cottus japonicus* Pallas. *Parapercis* Bleeker has therefore to stand for *Percis* Bl. Schn. Steindachner (Sitzber. Akad. Wien LXXXVIII, 1883, p. 1072) apparently not aware of Bleeker's paper, used *Parapercis* for a new genus and a new species. *P. ramsayi,* distinguished from *Percis* Bl. Schn. by the presence of teeth on the palatines. Soon he discovered his mistake, for a footnote in Steindachner & Döderlein's Fische Japans III (Denkschr. Akad. Wien XLIX, 1884, p. 212) runs as follows: "Da der von mir im Jahre 1883 vorgeschlagene Gattungsname „*Parapercis*" bereits früher von Dr. Bleeker für *Percis*-Arten ohne Rücksicht auf das Vorkommen oder die Abwesenheit von Gaumenzähnen gebraucht wurde, so ändere ich den Namen *Parapercis* Steind. (nec Blkr.) in *Neopercis* Steind. et Döderl. ab. In die Gattung *Neopercis* fallen somit *N. Haackei* Steind., *N. aurantiaca* Döderl., *N. multifasciata* Döderl. und *N. sexfasciata* Schleg. Die Gattung *Parapercis* Blkr. (nec Steind.) hat keine Berechtigung und umfasst sowohl *Percis*-Arten (ohne Gaumenzähne) als auch *Neopercis*-Arten (wie *Percis sexfasciata* Schleg.)".

According to Steindachner the only difference between *Percis* (*Parapercis*) and *Neopercis* is the presence of palatine teeth in the latter. *Parapercis cylindrica,* the type of Bleeker's genus, however, has also teeth on that bone, although this was unknown to Bleeker. As far as I can see Whitley was the first to record palatine teeth in this species. It is true that they are but poorly developed, and in a single series, whereas in the species of *Neopercis* they are arranged in several rows. All the same *P. cylindrica* forms a transition between the species without (*Parapercis*) and those with well developed palatine teeth (*Neopercis*) and it remains doubtful if lastnamed genus can be retained. Generally the presence of palatine teeth is accompanied by another characteristic viz. the last dorsal spine which is much shorter than the preceding in *Parapercis,* whereas they are of about the same length in *Neopercis.* This has been used by McCulloch (Austr. Zool. II, Part III, 1922, p. 101) to distinguish *Neopercis* (as a subgenus of *Parapercis*). Here however there is an exception too as in *Neopercis haackei* Steind. the last dorsal spine is by far the shorter and hence the dorsal fin is notched between the spinous and the soft part.

I think it therefore impossible to separate the genera *Parapercis* and *Neopercis.*

Key to the Indo-Australian species of *Parapercis*

I. Four dorsal spines. Ll. 64 . . . . 1. *P. quadrispinosa* p. 15.

II. Five dorsal spines, the fifth as long as the fourth. Teeth on palatines present . . . . 2. *P. striolata* p. 18.

III. Five dorsal spines, the fifth much shorter than the fourth. Teeth on palatines generally absent.

a. Ll. 49-51. Ltr $\begin{array}{c}2\frac{1}{2}\text{-}3\\ \hline 1\\ \hline 13\text{-}14\end{array}$. A row of teeth on palatines. Body encircled by about 9 dark cross bands . . . . 3. *P. cylindrica* p. 19.

b. Ll. 58-71. Ltr. $\begin{array}{c}5\text{-}8\\ \hline 1\\ \hline 9\text{-}18\end{array}$

- *a*^{1}. 5-6 anterior rays of D. filamentous . 4. *P. filamentosa* p. 21.
- *b*^{1}. No filamentous dorsal rays.
  - *a*^{2}. Dorsal and generally also anal with rows of dark spots.
    - *a*^{3}. Ltr $\begin{array}{c}5\text{-}6\\ \hline 1\\ \hline 14\text{-}18\end{array}$. A light central blotch on caudal . . . . . . 5. *P. xanthozona* p. 22.
    - *b*^{3}. Ltr. $\begin{array}{c}8\\ \hline 1\\ \hline 16\end{array}$. Black central blotch on caudal. Three or more dark white edged ocelli on sides . . 6. *P. hexophthalma* p. 24.
    - *c*^{3}. Ltr. $\begin{array}{c}9\\ \hline 1\\ \hline 18\end{array}$. Three longitudinal series of white blotches, each with a black centre. A suprascapular ocellus . . . . 7. *P. tetracanthus* p. 26.
  - *b*^{2}. Dorsal generally and anal always without rows of dark spots.
    - *a*^{3}. Ltr. $\begin{array}{c}5\\ \hline 1\\ \hline 13\end{array}$. Five pearly spots along back. Brownish spots along lowerhalf of sides. Caudal with two brown spots, the lower followed by a white spot . . . . 8. *P. alboguttata* p. 27.
    - *b*^{3}. Ltr. $\begin{array}{c}5\\ \hline 1\\ \hline 14\text{-}16\end{array}$ Preopercle coarsely serrated. Whitish with dark vertical bands . . . . 9. *P. punctata* p. 28.

1. *Parapercis quadrispinosa* (M. Web.)

?*Bodianus tetracanthus* Lacepède, Hist. Nat. Poissons IV, 1802, p. 285, p. 302.
Percis tetracanthus Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 458 (nec Lac.).
Percis tetracanthus Günther, Cat. Brit. Mus. II, 1860, p. 241.
Percis tetracanthus Kner & Steindachner, Sitzber. Akad. Wien LIV, 1866, p. 362.
Percis tetracanthus Günther, Fische der Südsee II, 1876, p. 158.
Percis tetracanthus Alcock, Journ. Asiat. Soc. Bengal LXV, 1896, p. 316.
Percis tetracanthus Garman, Bull. Mus. Harv. Coll. XXXIX, N° 8, 1903, p. 233.
Parapercis tetracanthus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 414.
Parapercis tetracanthus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 281.
?*Parapercis clathrata* Ogilby, Proc. Royal Soc. Queensl. XXIII (1910) 1911, p. 41.
Parapercis tetracanthus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 516.
Percis quadrispinosus M. Weber, Siboga Exp. Fische, 1913, p. 519.
Parapercis tetracanthus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 424.
Parapercis quadrispinosa Herre, Notes Fish Zool. Mus. Stanf. Univ. 1934, p. 95.
Parapercis clathrata Martin & Montalban, Philipp. Journ. Sc. LVI, 1935, p. 222.
Parapercis montillai Martin & Montalban, ibid. p. 224.

D. IV. 21. A. 17. P. 2. 15. V. I. 5. Ll. 64.

Height 6.6, 7.8 in length with caudal. Head 3.5, 4.1 in length with caudal. Eyes 4.5, 1.4 in snouth, and rather close together, the interorbital space 2.6 in eye. Mouth somewhat oblique, lower jaw slightly projecting. Lips thick. Maxillary reaching to below front-border of eye. A band of villiform teeth anteriorly in both jaws, that in the lower jaw narrower than that in the upper jaw and continued laterally as a row of larger pointed and somewhat curved teeth; still larger ones, as caninoids, in front of the band near symphysis. In the upper jaw a similar row of caninoid teeth in front of the band. Vomer with a band of minute villiform teeth. Palatines toothless. Anterior nostrils with a short posterior flap. Scales ctenoid, cycloid on breast and belly, before dorsal where there are about 11 rows of scales, and on head. About 15 transverse rows of scales on the cheeks, leaving a narrow posterior and inferior preopercular limb naked. Opercle with one strong spine. Second and third dorsal spines subequal, slightly less than eye and about twice as long as first and fourth spines. First dorsal ray much longer than spines, the rays slightly increasing in length posteriorly to about the 8th which equals snout and half eye; then decreasing again to the last. Anal similar to dorsal, but shorter. Pectorals equal to head without snout; ventrals half length of snout longer. Caudal slightly rounded. Colour of preserved specimen brownish above, lighter below and on sides. 10 dark brown cross bars on sides and belly, indistinctly bordered by lighter, the first through pectoral base, which has a white spot in the middle, the second below origin of dorsal, the last through caudal peduncle at base of caudal. The dark brown colour of the back descends above each cross bar, the demarcation between this colour and the lighter sides forming a festooned line. Head with large black spots above. Lips light, barred vertically with about three brown bands. A large dark blotch below eye and another near the rounded angle of the preopercle, more or less connected with a blotch at the infero-posterior border of the eye; these blotches more or less continued as transverse bands on throat and on interopercle. Another less distinct dark blotch on opercle. A row of almost black spots at the basal parts of the spinous and the soft dorsal, lastnamed also with a median and a subterminal row of somewhat lighter and smaller spots. Anal light, each ray with a subterminal dark spot. Ventrals and pectorals light. Caudal light in the middle, the base, the sides and a subterminal hindborder consisting of dark, almost black, spots. Length 170 mm.

Habitat: Sumatra (Padang); Java (Jakarta, Patjitan); Sangi Islands; Sula Islands; Buru; Ambon. — Ceylon, Bay of Bengal, Andamans, Riu Kiu Islands, Philippines, Pelew Islands, Guam, New Hebrides, Rotuma, Fiji, Samoa, Society Islands. In sea.

Note. Bleeker (1853) described *Percis tetracanthus* apparently unaware that Lacepède (Hist. Nat. Poissons IV, p. 428, p. 473) had described a *Labrus tetracanthus* and (ibid. IV, p. 285, 302) a *Bodianus tetracanthus* which both, according to Cuvier & Valenciennes (Hist. Nat. Poissons III, p. 268) belong to the genus *Percis*. The first of Lacepède's species has been reexamined by the french authors and they found not four, but five spines in the first dorsal and therefore changed the name into *cancellata*. Speaking of the second species they say that it is "très probablement la même espèce" but that "il ne serait pas impossible non plus que ce fût l'un des percis précédens", all of which have 5 dorsal spines. Lacepède described his *Bodianus tetracanthus* after a single specimen in the collection of the Museum d'Histoire Naturelle in Paris. Cuvier & Valenciennes apparently could not retrieve this specimen and it is therefore very improbable that it still will turn up. It is unknown where it has been collected and the description says no more than: D. 4. 21, A. 17, opercle with two spines, head somewhat depressed and broader than the body. Upper lip thick and protractile; teeth slender, hooked and unequal. From this, as Cuvier & Valenciennes rightly remarked, it follows that Lacepède described a species of *Percis* (*Parapercis*) and the only "point d'apui" is the statement that there are 4 dorsal spines. This enduced Günther (1860) to put it with a query among the synonymy of Bleeker's *Percis tetracanthus.* As is well known by everyone who uses the catalogues of the British Museum the author's name is not mentioned behind that of the species in the text, but it is in the "Systematic Index" and here this species is referred to as *Percis tetracanthus* Lac. The other *Percis tetracanthus* of Lacepède (*Labrus tetracanthus*) is called *cancellata* C. V. This induced Ogilby (l.c.) to create the name *Parapercis clathrata* in a list of the species of *Parapercis* which probably occur along the coast of Queensland with the following words: "5. *Parapercis clathrata;* nom. subst. for *Percis tetracanthus* Lacepède, ibid. IV, 1803, pp. 285 and 302; inadmissible on account of the preceding species". This preceding species is: "4. *Parapercis tetracantha* (Lacepède), Poiss. III, 1802, p. 473 and 488: *Percis cancellata* C. V.". The page references show that Ogilby meant *Labrus tetracanthus* Lac. for the first and *Bodianus tetracanthus* Lac. for the second. As shown above it is impossible to prove that this second species is a synonym of *Percis tetracanthus* Blkr and hence I have put *Bodianus tetracanthus* Lac. as well as *Parapercis clathrata* Ogilby with a query amongst the synonymy of Bleeker's species. On the other hand, as Ogilby ranged his *clathrata* amongst the species which probably occur along the coasts of Queensland, it is clear that he cannot have meant the species of Lacepède, the habitat of which is unknown, but most probably the species which Günther called by that name and which is *Percis tetracanthus* of Bleeker. Now M. Weber (l.c.) has proposed the name of *Percis quadrispinosus* to replace that of Bleeker and this name has been used by Herre (l.c.), but Martin & Montalban (l.c.) adopt the name *clathrata* and defend this opinion by referring to Opinion I rendered by the International Commission of Zoological Nomenclature. Reading this opinion which tells us how the word "indication" in Art. 25. a of the Rules of Nomenclature is to be constructed, it appears that the authors had in mind the 3rd of the three possibilities for an indication with regard to specific names and which says that "an indication is a definite citation of an earlier name for which a new name is proposed".

Ogilby's citation is definite and applies to the species *Bodianus tetracanthus* of Lacepède, not to *Percis tetracanthus* of Bleeker. Therefore I disagree with Martin & Montalban and I even think that the Rules of Nomenclature forbid the use of the name *clathrata* as a substitute for *tetracanthus* Bleeker, as long as it is not proved that *tetracanthus* Lac. and *tetracanthus* Blkr. are the same.

Bleeker does not mention the presence of a suprascapular ocellus and it lacks also in the specimen described by me, but Günther says that the coloration is similar to that of cancellata, which has such an ocellus. Martin & Montalban separated the specimens with an ocellus, calling them *clathrata*, from those without, which they call *montillai*. The latter agrees with Bleeker's description. Possibly the presence or absence of the suprascapular ocellus is a sexual character.

2. **Parapercis striolata** (M. Weber) (Fig. 6, p. 19)

Neopercis striolata M. Weber, Siboga Exp. Fische 1913, p. 520.

D. V. 23. A. 20 (21). P. 1. 8. V. I. 5. Ll. 64. Ltr. $\begin{array}{c} 4^{1}/_{2} \\ \hline 1 \\ \hline 14 \end{array}$.

Height 4.8, 5.7 in length with caudal. Head 3.4, 4.1 in length with caudal. Eye 3.2, about equal to snout, rather superior. Interorbital space one fifth of the horizontal diameter of the eye. Mouth slightly oblique, chin slightly prominent. Lips thick. Maxillary reaching to below frontborder of eye. Upper jaw with a band of about 7 rows of pointed teeth, the outer row somewhat distant from the others and consisting of much larger, somewhat curved teeth. In the lower jaw a band of about 5 rows, the outer row consisting of larger teeth, those near symphysis strong and curved canines. The bands in both jaws tapering laterally. Two incomplete rows of pointed teeth on the vomer and on the palatines. Anterior nostrils tubular with a short posterior flap. Scales ctenoid, cycloid on breast and belly and on preopercle, where they are arranged in about 10 transverse rows, leaving a broad posterior and inferior limb naked. Opercle with ctenoid scales and with two flat spines. Scales on upper part of head beginning behind eye. Dorsal spines increasing in length to the fourth, which is as long as the fifth and as horizontal diameter of eye. Dorsal rays somewhat increasing in length to the 8th, which equals snout and eye together. Anal similar to soft dorsal, but lower, the longest rays about equal to eye. Pectorals half diameter of snout shorter than head. Ventrals equal to head without snout. Caudal rounded, colour of preserved specimen yellowish. Scales of upper part of head, and of body and tail above lateral line, each with a brown spot, the spots forming longitudinal rows. A few similar rows on anterior part of body below lateral line. Spinous dorsal black, membranes of soft dorsal and anal lacking in the specimen examined but the rays are white, as also pectorals, ventrals, and caudal, lastnamed somewhat mottled. Description made after the type and single specimen known, long 155 mm.

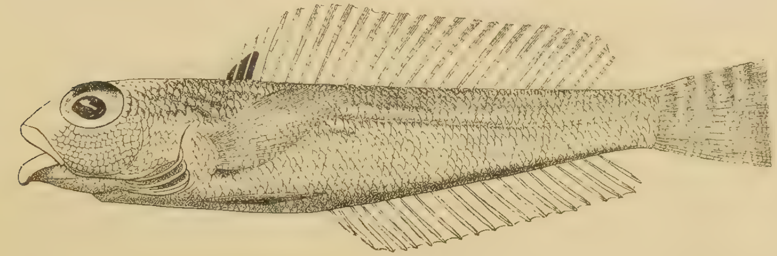

Fig. 6. *Parapercis striolata* (M. Web.) × 2/3.

Habitat: Near Kei Islands, 310 M: Fine greyish mud.

Note. *Parapercis sexfasciata* (Schl.), a Japanese species which has also the last dorsal spine as long as the fourth, has been recorded from Singapore by Karoli (Termeszetrajzi füzetek V, 1882, p. 16). As the localities of Karoli are often erroneous, I think this must be a mistake.

3. **Parapercis cylindrica** (Bl.)

Sciaena cylindrica Bloch, Ausländ. Fische VI, 1792, p. 42.
Bodianus sebae Bloch Schneider, Syst. Ichth. 1801, p. 335.
Sciaena cylindrica Lacepède, Hist. Nat. Poissons IV, 1802, p. 309.
Percis cylindrica Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 267.
Percis cylindrica Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 235.
Percis cylindrica Günther Cat. Brit. Mus. II, 1860, p. 239.
Parapercis cylindrica Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 236.
Parapercis cylindrica Waite, Rec. Austr. Mus. III, 1900, p. 209.
Parapercis cylindrica Jordan & Richardson, Bull. Bur. Fish. XXVII (1907) 1908, p. 281.
Parapercis cylindrica Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 424.
Parapercis cylindrica Whitley, Sc. Rep. Gr. Barrier Reef Exp. Brit. Mus. IV, N° 9, 1932, p. 296.
Parapercis cylindrica Giltay, Mem. Mus. Roy. Hist. Nat. V, Fasc. 3, 1933, p. 81.
Parapercis cylindrica Martin & Montalban, Philipp. Journ. Sc. LVII, 1935, p. 216.

Parapercis cylindrica Herre, Zool. Ser. Field Mus. Nat. Hist. XXI, 1936, p. 395.

D. V. 21. A. 8. 16 (17). P. 2. 13. V. I. 5. Ll. 49-51. Ltr. $\begin{array}{c}2\frac{1}{2}\text{-}3\\ \hline 1\\ \hline 13\text{-}14\end{array}$.

Height 3.7-4.4, 4.6-5.1 in length with caudal. Head 3.4-3.7, 3.7-4.4 in length with caudal. Eye rather superior, 3.6-4.1, 1.3-1.6 in snout. Interorbital space somewhat convex, narrow, one half or two fifths of eye. Mouth horizontal. Maxillary reaching to below frontborder of eye. Lips thick, especially the upper one. A very broad band of villiform teeth anteriorly in each jaw. A series of large pointed teeth before these bands, continued along the sides of the jaws. Two strong curved canines in the lower jaw and a pair of somewhat shorter ones in the upper jaw. Vomer with a few rows of teeth, the outer row enlarged. Palatines with a single row of teeth. Snout naked. Anterior nostril tubular. Preopercle with about 6 transverse rows of scales, leaving a broad posterior and inferior limb naked. Opercle scaly. Scales on upper part of head beginning some distance behind eye. Hindborder of preopercle smooth. Opercle with two strong spines. Dorsal spines rather strong, third and fourth longest, much longer than fifth and equal to snout. Middle dorsal rays longest, not quite as long as snout and eye together. Origin of anal below fifth dorsal ray. Anal similar to dorsal in depth. The membranes between the rays in both fins deeply incised. The last rays reach base of caudal when depressed. Pectorals as long as head without snout. Ventrals with the fourth ray by far the longest, almost as long as head. Caudal slightly rounded. Colour of preserved specimens brownish above, whitish below. A dark brown stripe from eye downwards, sometimes meeting that of the other side on isthmus. An oblique stripe from gillopening to ventral line, before origin of ventrals. Nine dark bands encircling belly, widening on the sides, and connected at the level of the lateral line with similar bands on the back, alternating with those of the sides. Spinous dorsal dark brown, the edge more or less light. Soft dorsal with rows of oblong dark spots. Caudal also spotted. Pectorals, ventrals, and anal creamy white, the base of lastnamed more or less chalky white. A chalky white spot on subopercle, not always distinct. Ventrals sometimes spotted with dark. Length 202 mm.

Habitat: Singapore; Celebes (Menado); Siau!; Sangi Islands!; Sulu Islands; Ternate; Sula Islands; Buru; Ceram; Ambon!; Nusa Laut!; Saparua; Banda!; Goram; Binongka!; Samau!; Solor; Flores!; Lomblen!; Rotti!; Timor; Kei Islands!; Aru Is-

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lands; between Misol and Salawatti!; Waigeu!; New Guinea. — China, Philippines, Coast of Queensland, New Hebrides, Lord Howe Island, Fiji, Friendly Islands. In sea.

Note. The species described by Day (Proc. Zool. Soc. London, 1888, p. 260) from the Andamans as *P. cylindrica* is not this species. It has Ll. 44, ltr. $\begin{array}{c}2\frac{1}{2}\\ \hline 1\\ \hline 9\end{array}$ and a dark ocellus at upper part of base of caudal.

4. **Parapercis filamentosa** (Steind.)

Percis filamentosa Steindachner, Sitzber. Akad. Wien LXXVII. 1. Abth. (1878) 1879, p. 386.
Parapercis longifilis Herre, Proc. Biol. Soc. Washington. LVII, 1944, p. 5.

D. V. 21-22. A. 17-18. Ll. 58-60. Ltr. $\begin{array}{c}5\frac{1}{2}\\ \hline 1\\ \hline 12\text{-}14\end{array}$.

Height $6^1/_3$-$5^2/_3$, head $4^2/_5$-$4^3/_5$ in total length. Eye somewhat more than 4, snout about $3^3/_5$, interorbital space $9^1/_2$-10 in length of head. Opercle ending in a sharp point. Propercle rather strongly denticulated. The free oblique border of the subopercle is denticulated too, the denticulations being more crowded and somewhat finer, especially near the supero-posterior end of the bone. Corner of mouth below frontborder of eye. Forehead, snout, and preorbital scaleless. 6-7 horizontal series of scales on cheek, below eye to lower border of preopercle. The pointed ventrals are about one eye-diameter shorter than head, and do not quite reach anal. Pectorals shorter than ventrals, but reaching further backwards, as their origin is behind base of ventrals. The dorsal spines increase rather rapidly in height to the fourth, the height of which equals one eye-diameter or is a little more. The last, fifth spine, is shorter than the third. The five or six anterior rays of the second dorsal are much produced and thread-like; the longest, second ray is somewhat more than 1-$1^2/_5$ times longer than head. In a specimen of 11 cm the sixth ray is only slightly shorter than head. In a small specimen, in which the five anterior dorsal rays only are elongated, the fifth ray is somewhat more than $^2/_3$ of length of head. The following rays gradually decreasing in length, the last one, which is split to its base, being only slightly longer than eye. Caudal slightly rounded. There are $5^1/_2$ rows of scales between the base of the first dorsal spine and the lateral line, 12-13 between the lateral line and the base of the first anal ray, and 14 between the lateral line and the median line on the belly at some distance before the anal. The row of scales of the lateral line is almost completely covered by the scales of the neighbouring rows. Caudal, and outer side of pectorals nearly totally covered with scales. Two rows of grey bands and blotches on side of body. The bands of the upper row, eight in number, reach from the back down to the lateral line, tapering inferiorly in the form of a triangle; they are placed in pairs, and inferiorly their borders are densely spotted with blackish brown. Alternating with these superior bands there is a second row of blotches, placed vertically and in such a way, that a large oval cloudy blotch is placed below and between each pair of the triangular transverse bands, followed by a much narrower blotch or stripe, which is, however, as high as the former. A brown blotch at the base of the upper caudal rays is always present, sometimes an other smaller one at base of lower rays. A grey vertical band over cheeks, beginning somewhat behind the middle of the lower border of eye. Upper lip greyish violet. Median part of lower side of ventrals greyish violet. Second dorsal and anal greyish white, indistinctly spotted with darker, the spots forming oblique bands. Length 115 mm(After Steindachner, not seen by me).

Habitat: Singapore.

Note. Steindachner remarks about this species, that it might be the male of *punctatus* C. V. as described by Day.

5. **Parapercis xanthozona** (Blkr.)

Percis xanthozona Bleeker, Verh. Bat. Gen. XIII, 1849. Bijdr. Percoïden, p. 55.
Percis xanthozona Günther, Cat. Brit. Mus. II, 1860, p. 240.
Percis xanthozona Playfair, Fishes of Zanzibar, 1866, p. 69.
Percis pleurostigma Sauvage, Poissons de Madagascar, 1890, p. 317.
Percis xanthozona Steindachner, Abh. Senckenb. naturf. Ges. XXV, 1901, p. 427.
Parapercis atromaculata Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII, Part 4. 1904. p. 548.
?*Parapercis hexophthalmus* Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 46 (nec Blkr).
Parapercis xanthozona Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 425.
Parapercis (Chilias) xanthozona McCulloch, Checklist Fish. Austr. Part III, 1929, p. 332.
Parapercis dorsonebulosa Martin & Montalban, Philip. Journ. Sc. LVI, 1935, p. 220.

D. V. 21. A. 18. P. 1. 16. V. I. 5. Ll. 66. Ltr. $\frac{6}{\frac{1}{18}}$.

Height 6.1, 7 in length with caudal. Head 3.6, 4.1 in length with caudal. Eye 4.1, 1.5 in snout. Interorbital space 2.5 in eye. Mouth somewhat oblique, lower jaw projecting. Lips thick. Maxillary reaching to below anterior border of eye. A villiform band of teeth in the jaws, tapering posteriorly, where the teeth are larger. Some curved caninoids in front of this band in both jaws. An elongate patch of rather large, rounded, granular teeth on vomer. No teeth on palatines. Anterior nostril with a short posterior flap. Scales ctenoid, those on head and before dorsal cycloid. On cheeks about 15 transverse rows of smaller somewhat elongate scales, leaving a posterior and an inferior limb naked. Opercle with a strong spine. First dorsal spine as long as half eye, following increasing gradually in length to the fourth, which equals eye in length. Fifth spine much shorter than fourth, about as long as first. First dorsal ray about as long as postorbital part of head, median rays longest, equal to snout, last ray as long as eye. Origin of anal below 7th dorsal ray, its end below that of dorsal. Anal similar to soft dorsal in depth. Pectorals equal to head without snout. Ventrals pointed, the fourth ray longest, somewhat longer than pectorals, their base well in advance of that of pectorals. Caudal slightly rounded. Colour of preserved specimen brownish red, belly lighter. A white longitudinal band from axil of pectoral to middle of base of caudal, and continued to the end of that fin. About nine indistinct dark cross bars on body and tail, interrupted by the white longitudinal band. Head with indistinct dark markings. Fins whitish; spinous part of dorsal with a dark brown blotch at its base between the first to third spines. Soft part of dorsal with about 2-3, anal with a single longitudinal row of dark spots. Caudal with transverse rows of similar spots. Pectorals and ventrals without markings. Length 186 mm. (Description made after a specimen of Bleeker's collection in the Amsteram Museum).

Habitat: Singapore; Sumatra (Padang); Java (Jacarta); Halmahera; Ternate. — Madagascar, Mauritius, Zanzibar, Indochina, Philippines, Thursday Island, Solomon Islands, Coast of Queensland. In sea.

Note. Liénard (10. Rapport Soc. hist. nat. Maurice, 1839, p. 32) described a "Percis à taches aux flancs" which, as Sauvage rightly remarks, is the same as *P. xanthosoma.* Liénard, however, did not give a scientific name to his species, and therefore the name introduced by Sauvage l.c.: "*Percis pleurostigma* Lién," has no priority.

6. **Parapercis hexophthalma** (C. V.)

Percis cylindrica Rüppell, Atlas Reise N. Afrika, Fische, 1828, p. 19 (nec Bl.).
Percis hexophthalma Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 271. — ibid. VII, 1831, p. 507.
Percis polyophthalmus Cuvier & Valenciennes, ibid. III, 1829, p. 272.
Percis caudimaculata Rüppell, Neue Wirbelth. Fische, 1835, p. 98.
Percis caudimaculata Bleeker, Verh. Bat. Gen. XXIII, 1849, Bijdr. Percoiden, p. 54.
Percis hexophthalma Montrouzier, Ann. Sc. Soc. d'Agr. Lyon (2) VIII, 1856, p. 499.
Percis hexophthalma Günther, Cat. Brit. Mus. II, 1860, p. 239.
Percis polyophthalma Playfair, Fishes of Zanzibar, 1866, p. 68.
Percis hexophthalma Playfair, l.c.
Parapercis hexophthalmus Bleeker, Versl. Akad. Amsterdam (2) I, 1868, p. 272.
Percis polyophthalma Klunzinger, Verh. zool. bot. Ges. Wien XX, 1870, p. 816.
Percis caudimaculatum Haly, Ann. Mag. Nat. Hist. (4) XV, 1875, p. 269.
Percis hexophthalma Day, Fishes of India, Part II, 1876, p. 263.
Percis polyophthalma Klunzinger, Fische des Rothen Meeres I, 1884, p. 123.
Parapercis hexophthalmus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 516.
Parapercis hexophthalma M. Weber, Siboga Exp. Fische, 1913, p. 518.
Parapercis hexophthalma Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 442.
Parapercis hexophthalma Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 424.
Parapercis (Chilias) hexophthalmus Mc Culloch, Checklist Fish. Austr. Part III, 1929, p. 332.
Parapercis hexophthalma Fortonese, Boll. Mus. Zool. Torino XLV, 1935-1936, p. 56.
Parapercis hexophthalma Martin & Montalban, Philipp. Journ. Sc. LVI, 1935, p. 219.

D. V. 21. A. 1. 17. P. 2. 15. Ll. 66-71. Ltr. $\begin{array}{c}8\\ \hline 1\\ \hline 16\end{array}$.

Height 5.5, 6.5 in length with caudal. Head 3.5, 4.2 in length with caudal. Eye rather superior, 5.2 in snout and about equal to flat interorbital space. Mouth horizontal. Maxillary reaching to below anterior part of eye. Lips thick, fleshy. Small teeth in villiform bands in the jaws, with an outer row of larger pointed teeth, some of which are caninoid, especially among the lateral ones in the lower jaw. Vomer with a patch of teeth, consisting of several rows, those of the anterior row larger than the others. Snout naked. Anterior nostril tubular with a short flap. Preopercle covered with small scales, more or less imbedded in the skin. Opercle scaly. Scales on upper part of head beginning behind eye. Hindborder of preopercle slightly rough. Opercle with two flat spines. Third and fourth dorsal spines subequal, longest about equal to eye. Fifth spine two thirds of fourth. Middle dorsal rays longest, equal to head without snout. Membranes between the rays deeply incised. Origin of anal below fifth dorsal ray. Anal spine inbedded in the skin, about half length of first ray. Anal similar to the dorsal in depth, the membranes between the rays in both fins deeply incised. End of anal below end of dorsal. Last rays of both fins reaching on caudal when depressed. Pectorals half length of snout shorter than head. Ventrals with the fourth ray by far the longest, longer than pectorals, but shorter than head. Caudal truncate. Colour of preserved specimen reddish brown, lighter below. Head with black spots above and oblique lines on cheeks (or spots in the female?). Some scales on upper parts of back and tail with a dark hindborder, these scales arranged in groups, forming short oblique stripes. On the sides three longitudinal rows of 7 or 8 dark elongate patches, those of the superior and inferior rows connected by indistinct dark cross bands, which are continued on belly; three of them (♂ ?) or more (♀ and young?) on tail ending in black, white edged ocelli. The median row consists of smaller patches, alternating with those of the other rows. Dorsal with a subterminal double or single narrow black band. A median longitudinal black band on spinous dorsal. Soft dorsal with a double longitudinal row of elongate black spots, one spot between two rays. Anal with a single row of similar but somewhat more rounded spots. Caudal with a narrow dark subterminal band and a large irregular black patch, more or less bordered by white, and surrounded by dark spots. A dark streak at base of pectorals, which otherwise are creamy as the ventrals. Length 230 mm.

Nomen indig. Ikan Marabahan (Malay, Jakarta).

Habitat: Pulu Weh!; Java (Jacarta); Celebes (Makassar, Menado); Gébé; Solor!; New Guinea (Manokwari). — Mozambique, Zanzibar, Seychelles, Red Sea, Coasts of India, Andamans, Cocos Keeling Islands, Tonkin, China, Japan, Riu Kiu Islands, Formosa, Philippines, Solomon Islands, Woodlark Island, Louisade Archipelago, New Hebrides, Coast of Queensland, Fiji, Society Islands. In sea.

Note. Specimens with 6-7 ocelli on the sides and spots on the sides of the head are perhaps females (cf. Playfair) or young (cf. Klunzinger), those with three ocelli and stripes on cheeks males.

7. **Parapercis tetracanthus** (Lac.) (Fig. 7, p. 26)

Labrus tetracanthus Lacepède, Hist. Nat. Poissons III, 1801, p. 428, p. 473.
Percis cancellata Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 268.
Percis cancellata Bleeker, Nat. Tijdschr. Ned. Indië IX, 1855, p. 501.
Percis cancellata Günther, Cat. Brit. Mus. II, 1860, p. 240.
Parapercis tetracanthus M. Weber, Siboga Exp. Fische, 1913, p. 518.
Parapercis tetracantha Martin & Montalban, Philipp. Journ. Sc. LVI, 1935, p. 217.

D. V. 21. A. 1. 17 (18). P. 2. 15-16. V. I. 5. Ll. 71-75. Ltr. $\frac{8\frac{1}{2}}{\frac{1}{12\text{-}14}}$.

Height 5.6-5.8, 6.5-6.8 in length with caudal. Head 3.3-3.4, 3.9-4 in length with caudal. Eye 4.7-5.4, 1.7-2 in snout. Interorbital space flat, 1.5-1.6 in eye. Mouth slightly oblique. Maxillary reaching to below frontborder of eye or nearly so. Lower jaw prominent. Lips thick. Villiform bands of teeth in the jaws, tapering posteriorly. An outer row of larger teeth, consisting anteriorly of distant canines, laterally of more crowded caninoid ones. Vomer with a semilunar patch of villiform teeth. No teeth on palatines. Anterior nostril small, tubular, with a short posterior flap. Posterior nostril a large rounded opening. Scales ctenoid, cycloid on thorax and belly; those on cheeks also cycloid, small and elongate, in about 25 oblique rows. Scales on opercle ctenoid. Opercle with a flat spine superiorly. Dorsal spines increasing in size to the fourth, which equals eye. Fifth spine one half or two thirds of fourth. Dorsal rays slightly increasing in length posteriorly to the 17th, which nearly equals snout and eye in length. Membranes between dorsal rays deeply incised, none of the rays filamentous. Pectorals and ventrals subequal, as long as eye and snout. Caudal slightly rounded. Colour of preserved specimens light yellowish. A narrow brown band from head to caudal; 8-9 broad transverse bands, the first over nape, the others connecting the longitudinal band with base of dorsal, the

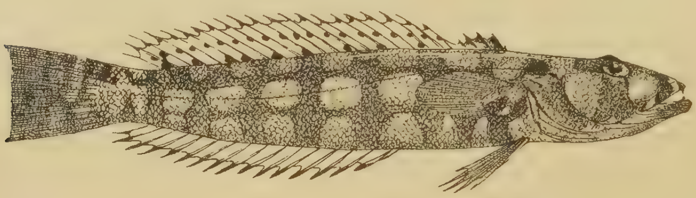


Fig. 7. *Parapercis tetracanthus* (Lac.) × 1/2.

last on caudal peduncle. These bands more or less distinctly edged with white. 8-9 similar transverse bands on lower sides, slightly alternating with those on back; the first through base of pectoral, the third just before anal, the following to anal and on caudal peduncle. The three anterior bands much darker on belly. A faint longitudinal band, parallel to and below the first, may be present. Scattered dark brown spots may be present on body and tail, especially on the light patches between the lower transverse bands. An ocellus on each side in scapular region, connected by the lower transverse band on nape, consisting of a white outer ring, a dark brown inner ring and a bluish centre, more or less spotted with brown. A transverse row of dark brown spots on interorbital space and similar rows before and below it, not always distinct. A broad brown band, bordered by white, from eye downward. Opercular region also brown. Interopercle white. Upper lip white with a median brown transverse band and a brown spot anteriorly. Lower lip with similar markings, but less distinct. Soft dorsal white, with 3 longitudinal rows of dark brown spots. Anal also more or less spotted. Caudal with 4 or 5 transverse rows of similar spots. A large brown blotch at its base superiorly. Pectorals and ventrals uniform white, pectorals sometimes with minute dots at their base. Length 233 mm.

Habitat: Singapore; Java (Patjitan); Flores; Adonara!; Timor; Buru; Halmahera; Batjan; Ambon; Banda!; Aru Islands; New Guinea (Kaimana!). — Mozambique, Philippines, Solomon Islands, Samoa. In sea.

8. **Parapercis alboguttata** (Gthr.)

Percis alboguttata Günther, Ann. Mag. Nat. Hist. (4) X, 1872, p. 424. — Brenchley's Cruise of the Curaçoa, 1873, p. 422. — Proc. Zool. Soc. London 1887, p. 662.

D. V. 22. A. I. 18. Ll. 60. Ltr. $\frac{5}{\frac{1}{13}}$.

The height of the body is contained $6^1/_2$ in the total length (without caudal), the length of the head $3^1/_2$; the width of the interorbital space is one third of the diameter of the eye, which is two-sevenths of the length of the head, and not quite equal to the length of the snout; lower jaw slightly projecting beyond the upper; the maxillary extends somewhat behind the vertical from the front margin of the orbit; cheek covered with minute scales to below the middle of the eye; the fourth dorsal spine is rather longer than the third and about twice as long as the fifth; the ventral fins reach to the vent; caudal truncated. Brownish olive with a series of five small pearl-coloured spots on each side of the back, along the base of the dorsal fin; a series of indistinct brownish spots along the lower half of the side; caudal fin with a pair of brown spots on the base, the lower spot being followed by an ovate white spot; fins without distinct markings (Not seen by me, copied after Günther). Length 150 mm.

Habitat: Misol. — Muscat.

9. **Parapercis punctata** (C. V.)

Percis punctata Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 264.
Percis punctata Day, Fishes of India, Part II, 1876, p. 262.
Parapercis punctata M. Weber, Siboga Exp. Fische, 1913, p. 519.

D. V. 21-22. A. 2. 17-18. Ll. 58-60. Ltr. $\begin{array}{c}5\\\hline 1\\\hline 14\text{-}16\end{array}$.

Height 6-6.5 in total length. Head 4.5-5 in total length. Eye 4, 1-1.25 in snout. Interorbital space 4 in eye. Snout sharp. Preopercle coarsely serrated along its posterior border. Edge of subopercle serrated. A shoulder spine. Above the symphysis of the lower jaw an outer enlarged row of about eight curved teeth, the outermost of which are the largest. Spines of dorsal of moderate length, the fourth longest and 1.3 diameter of eye in length, the third a quarter shorter. Ventrals reaching the vent. Caudal cut square or a little rounded. Whitish, with reddish brown vertical bands and blotches above the lateral line, which are interrupted along the middle of the body; on these bands a few black spots. A bright golden line from below orbit to base of dorsal, and another from centre of eye to snout. Spinous dorsal with or without a row of black spots. Soft dorsal with three rows of spots on the rays. Anal yellowish. Caudal with two greyish bands, one at its base, the other on its posterior third, and sometimes an ocellus at upper part of base. Ventrals slate coloured. Length 125 mm. (After Day, not seen by me).

Habitat: Singapore; Nusa Laut.-Coast of India and Ceylon.

Doubtful species

Parapercis ocellata (C. V.)

Percis ocellata Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 270.

This species is based on a figure in Renard (Hist. Nat. des plus rares curiosités de la mer des Indes, 1754, T. 1, Pl. 6, fig. 42), and represents a brown fish, with 3 longitudinal rows of black, green-edged ocelli on the sides of the body and a light longitudinal band from head to caudal. The dorsal and anal are light yellowish, with white, black-edged ocelli, and there is a greenish, blue-edged ocellus on the green caudal. It is impossible to recognize in this figure one of the known species of *Parapercis* and it is even doubtful if it represents a *Parapercis* at all.

2. Family TRICHONOTIDAE

Body much elongate, covered with small cycloid scales. Lateral line running along middle of sides. Dorsal long, continuous, or the two anterior unarticulated rays separate and much prolonged (males). Anal long, with a feeble spine. Pectorals with a narrow base. Ventrals somewhat in advance of pectorals, separated by a narrow interspace, each of a spine and 5 branched rays. Eyes close together. Mouth large, horizontal, protractile, terminal, with the lower jaw projecting. Maxillary not or scarcely exposed. Villiform teeth in jaws and on vomer and palatines. Preorbital without spine. Suborbital well ossified. Gillmembranes not united, free from isthmus. Seven branchiostegals, four gills. Pseudobranchiae present.

Distribution: Tropical and subtropical parts of Indic and Pacific.

1. **Trichonotus** Bloch Schneider

(Bloch Schneider, Syst. Ichth. 1801, p. 179)

Taeniolabrus Steindachner, Sitzber. Akad. Wiss. Wien LV. I. Abth. 1867, p. 713.

For characters and distribution of the single genus see those of the family.

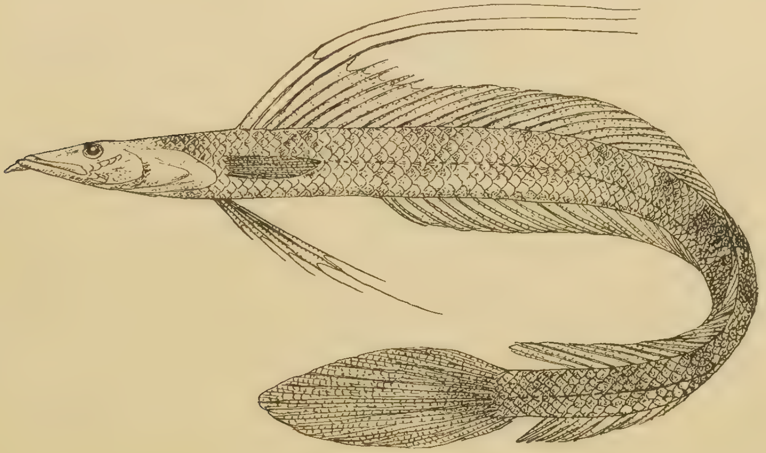
Note. *Lesueurina platycephala* Fowler (Proc. Acad. Nat. Sc. Philadelphia LIX (1907) 1908, p. 440) from Australia, agrees with *Trichonotus* in having the lower jaw projecting, but the origin of the anal is in advance of that of the dorsal, the eyes are widely separated and the head is scaly. For these reasons I do not include it into the family Trichonotidae, in which it has been placed by McCulloch (Checklist Fish. Austr. Part III, 1929, p. 333).

1. **Trichonotus setiger** Bl. Schn. (Fig. 8, p. 31)

Trichonotus setiger Bloch Schneider, Syst. Ichth. 1801, p. 179.
Trichonotus setiger Cuvier & Valenciennes, Hist. Nat. Poissons XII, 1837, p. 316.
Trichonotus polyophthalmus Bleeker, Nat. Tijdschr. Ned. Indië V, 1853, p. 243.
Trichonotus setiger Bleeker, ibid. VII, 1854, p. 251.
Trichonotus setigerus Günther, Cat. Brit. Mus. III, 1861, p. 484.
Taeniolabrus filamentosus Steindachner, Sitzber. Akad. Wiss. Wien LV. I. Abth. 1867, p. 713. — Ann. Mag. Nat. Hist. (3) XX, 1867, p. 79.
Trichonotus setigerus Günther, Journ. Mus. Godeffroy IV, Heft 4, 1874, p. 266.
Trichonotus setiger Day, Fishes of India, Suppl. 1888, p. 795.
Taeniolabrus cyclograptus Alcock, Ann. Mag. Nat. Hist. (6) VI, 1890, p. 430.
Trichonotus setigerus Johnstone, Pearl Oyster Rep. II, Fishes, 1904, p. 215.
Trichonotus setiger Rendahl, Kgl. Svensk. Vetensk. Akad. Handl. LXI, N° 9, 1904, p. 20.
Trichonotus setiger Whitley, Rec. Austr. Mus. XVI, 1927, p. 26.
Trichonotus setiger Giltay, Mem. Mus. Roy. Hist. Nat. V, 1933, p. 82.
Trichonotus setiger Herre, Philipp. Journ. Sc. LIX, 1936, p. 370.
?*Taeniolabrus marleyi* Smith, Trans. Roy. Soc. S. Africa XXIV, 1936, p. 4.
Trichonotus setigerus Blegvad, Danish Sc. Inv. Iran, Part III, 1944, p. 156.

D. 46-47. A. 36. V. I. 5. Ll. 60. Ltr. $\begin{array}{c}4\\ \hline 1\\ \hline 4\frac{1}{2}\end{array}$.

Height 13.4-13.7, 16.6-17.3 in length with caudal. Head 4.6-5.2, 6-6.3 in length with caudal. Eye 6.1-7.2, 1.7-2 in snout. Interorbital space narrow, one fourth or three eighths of eye. Lower jaw the longer, with a fleshy symphysial knob. Teeth pointed, those of the lower jaw hooked. Head naked, excepting two rows of small scales, starting from corner of mouth, one running obliquely upwards and backwards to behind eye, the other obliquely down and backwards. The membranes between the rays of dorsal and anal deeply incised, the rays somewhat filamentous, especially the anterior ones of the dorsal. In males the first and second detached rays of dorsal are very long and reach on posterior half of dorsal when laid down. Pectorals pointed, as long as postorbital part of head. Ventrals pointed, half length of snout less than head. Colour of preserved specimens brown. A black spot at hindborder of each scale of lateral line may be present. Dorsal, posterior part of anal, and basal half of caudal with many small black edged ocelli, arranged in longitudinal rows on dorsal and anal, in transverse rows on caudal. According to authors head, body, and tail are covered with similar ocelli, but not distinct in the specimens examined. Pectorals and ventrals yellowish, lastnamed dusky brown at tip. Length 190 mm (Specimens of Bleeker's collection in the Leiden Museum seen by me).



Fg. 8. *Trichonotus setiger* Bl. Schn. n. s.

Habitat: Bali; Celebes (Menado); Ceram; Ambon; Nusa Laut.-Durban, Muscat, Persian Gulf, Coast of India, Cargados Carajos, Andamans, China, Philippines, Coasts of Queensland. In sea and brackish water.

Note. The scales on the head have been overlooked by previous authors, excepting Rendahl (1921 l.c.) and Smith (1936, l.c.). The latter therefore thought that the specimens examined by him represented a new species.

3. Family HEMEROCOETIDAE

Body elongate, covered with large scales. Lateral line running along middle of sides. A short spinous dorsal present or absent. Soft dorsal and anal rather long. Pectorals with a broad base. Ventrals somewhat in advance of pectorals, well separated, each of a spine and 5 branched rays. Eyes rather large and close together. Mouth large, oblique, protractile, terminal, the lower jaw somewhat included. Maxillary slightly exposed distally, without supramaxillary. Preorbital with a spine anteriorly 1). Villiform teeth in the jaws and in two separate patches on the vomer; none on the palatines. Gillmembranes not united and free from isthmus. 6 branchiostegals, 4 gills. Pseudobranchiae present.

Distribution: Two genera with few species from Japan, the Indo-Australian Archipelago, Australia, New Zealand, and Hawaii. In sea, at moderate depths.

1. **Acanthaphritis** Günther

(Günther, Zool. Challenger Exp. Part IV, 1880, p. 43)

Pteropsaron Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV (1901) 1902, p. 470.

Head depressed, tail compressed. Cleft of mouth oblique, with the upper jaw the longer. Each of the preorbitals with a horizontal spine pointing forwards. Eye rather large or very large, obliquely directed upwards. Scales large, ciliated or partly cycloid. Head scaly, but the cheeks sometimes scaleless. Two separate dorsal fins, the first short with IV-VI spines, the second with 17-22 rays. Anal with 22-27 rays. Pectorals rounded, with a broad base. Ventrals inserted before pectorals, with I spine and 5 rays. Caudal truncate or rounded.

Distribution: A few species from Japan, the Kei Islands, and Lysan. Living apparently in rather deep water.

Note. Regan (Ann. Mag. Nat. Hist. (8) XII, 1913, p. 141) united *Pteropsaron* with *Acanthaphritis*. Jordan (Classif. of Fishes, 1923, p. 229) denies this synonymy as the two genera "differ in several respects". When comparing the diagnoses of *Acanthaphritis* as given by Günther and of *Pteropsaron* as given by Jordan & Snyder we find the following differences:

Acanthaphritis:	*Pteropsaron*:
Scales ciliate	Scales cycloid
Vomerine teeth present	Vomerine teeth absent
Preorbital spine present	Preorbital spine absent

Jordan & Richardson (Bull. Bur. Fish. XXIII, Part II, 1905, p. 647) describing *Pteropsaron incisum*, mention, however,

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1) Tate Regan (Ann. Mag. Nat. Hist. (8) XII, 1913, p. 141) describes this spine as a maxillary one, situated just in front of the preorbital. All other authors speak of a preorbital spine. As I have seen no specimens I do not know who is right.

teeth on the vomer: "We find the vomer toothed, whereas *P. verecundum* is said to have it naked; but this is probably an error of observation, as teeth are present also on the vomer of *P. evolans* Jordan & Snyder, in which they are likewise said to be wanting". The preorbital of *P. incisum* is described as follows: "each preorbital ends anteriorly in a strong spine directed forward, the tip of snout between the 2 spines deeply notched behind the mesial portion of the premaxillaries; the tip of snout is notched and spinous also in *P. verecundum* and in *P. evolans*". I deduct from this sentence that preorbital spines are also present in the two species *verecundum* and *evolans*.

There only remains the difference in the scales. Indeed, according to Günther they are "coarsely ciliated" in *A. grandisquamis* and according to Jordan & Snyder and Jordan & Richardson cycloid in the species of *Pteropsaron,* but lastnamed authors add in the description of *P. incisum*: "excepting those forming the lateral line; in the latter, the free margins are incised to form 3 or 4 coarse teeth. Scales entirely similar in *P. evolans*".

I have not had the opportunity to study specimens either of *Acanthaphritis* or of *Pteropsaron,* but unless more prominent differences are detected I think Regan was right in uniting the two genera.

1. **Acanthaphritis grandisquamis** Gthr (Fig. 9, p. 33)

Acanthaphritis grandisquamis Günther, Zool. Challenger Exp. VI, 1880, p. 43.

D. V-VI-20. A. 24. L. l. 33. Ltr. 8.

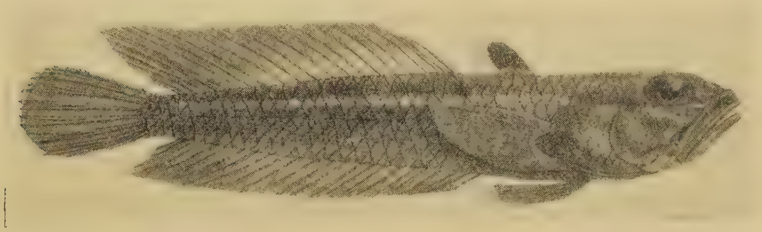

Fig. 9. *Acanthaphritis grandisquamis* Gthr. After Günther.

Head depressed, its length being rather more than two-sevenths of the total length (without caudal); the eyes are large, occupying the second fourth of the length of the head, and standing very close together; mouth wide, the maxillary extending to below the middle of the eye. Occiput, cheeks, and opercles scaly. The first dorsal composed of feeble and short spines; the second high, the posterior rays being the longest, and extending in old specimens to the middle of the caudal fin. The anal commences immediately behind the first dorsal; caudal subtruncated; pectoral broad, reaching to below the commencement of the second dorsal; ventrals reaching to the vent. The scales are very coarsely ciliated. Light olive coloured, with an indistinct series of silvery spots along the upper side of the body; the first dorsal black. Length 137 mm. (After Günther, not seen by me).

Habitat: Kei Islands, 232 M.

4. Family OPISTHOGNATHIDAE

Body elliptical to elongate, moderately compressed, more or less completely covered with small cycloid scales. Head more or less depressed, naked. Lateral line single, running high, incomplete, ending near middle of dorsal fin. Dorsal continuous, with the spinous and soft-rayed parts subequal; anal with 2 spines, caudal with 14 or 15 principal rays, 12 or 13 branched. Ventrals close together, slightly in advance of pectorals, each of a spine and 5 soft rays, without axillary process. Mouth terminal, nearly horizontal, protractile. Jaws normally formed. Maxillary broad, exposed, with supramaxillary. Villiform or cardiform teeth in the jaws and sometimes on vomer. Two nostrils on each side. Gillmembranes free from the isthmus. 6 branchiostegals, 4 gills. Pseudobranchiae present.

Distribution: Temperate and tropical parts of West Atlantic, Indic, and Western Coasts of Pacific, reappearing on the Coast of California. Fishes of small or moderate size, living on rocky or sandy bottom.

1. **Opisthognathus** Cuvier

(Cuvier, Règne Animal, Ed. I. Tome II, 1817, p. 252)

Maxillary long, reaching far behind eye, truncate or more or less pointed behind. Teeth in the jaws in several rows, the outer row consisting of larger somewhat curved pointed teeth. Dorsal with X-XIII flexible spines and 10-17 branched rays. Anal with II flexible spines and 10-16 rays. Caudal rounded.

Distribution: Red Sea, Indic, Western Coasts of Pacific and tropical Coasts of West Atlantic.

Key to the Indo-Australian species of Opisthognathus

A. Maxillary reaching beyond hindborder of preopercle, ending in a point directed upwards (*Opisthognathus* s.s.).
- *a*. Sq. l. more than 100 . . . . 1. *O. castelnaui* p. 35.
- *b*. Sq. l. about 65 . . . . 2. *O. solorensis* p. 36.

B. Maxillary not reaching as far backward as hindborder of preopercle, truncate behind (*Gnathypops*).
- *a*. Ll. 110-120. A. II. 15-16 . . . . 3. *O. papuensis* p. 37.
- *b*. Ll. 105. A. II. 13 . . . . 4. *O dendritica* p. 38.
- *c*. Ll. 66-69. A. II. 13-14 . . . . 5. *O. rozenbergi* p. 38.
- *d*. Ll. 80. A. II. 11 . . . . 6. *O. moenensis* p. 39.
- *c*. Ll. about 50. A. II. 10. . . . . 7. *O. versluysi* p. 40.

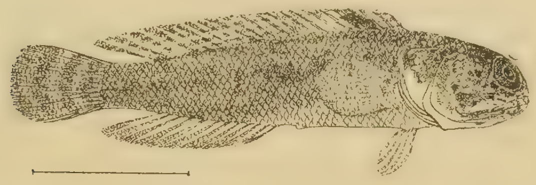

Fig. 10. *Opithognathus versluysi* M. Web.

1. **Opisthognathus castelnaui** Blkr.

Opisthognathus Sonneratii? Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 221.

Opisthognathus Castelnaui Bleeker, Arch. Neerl. Sc. Nat. IX (1873) 1874, p. 468, p. 469.

Opisthognathus suluensis Herre, Copeia 1933, p. 25.

D. XI. 14. A. II. 14 (15). P. 2. 14. V. I. 5. Sq. l. about 132.

Height 5.3-6.1, 5.9-7.1 in length with caudal. Head 3.3-3.7, 3.9-4.4 in length with caudal. Eye 3.6-3.7. Snout blunt, 1.5-1.6 in eye. Interorbital space narrow, slightly concave, 2.4-2.5 in eye. Anterior nostril with a rim, posterior nostril a rounded opening. Maxillary produced into a pointed, flexible, upturned flap, reaching somewhat beyond hindborder of opercle. Teeth pointed, curved, in several rows anteriorly, in one row laterally; the outer row in both jaws consisting of enlarged teeth. Head, nape, and thoracal region scaleless. Lateral line ending below third dorsal ray. Membranes of spinous part of dorsal not, those of soft dorsal and of anal distinctly incised. Last dorsal spine equalling snout and eye, longest dorsal rays slightly longer. Anal similar to soft dorsal. Pectorals as long as snout and eye. Ventrals pointed, slightly longer than pectorals. Caudal rounded. Colour of preserved specimens brown, irregularly clouded with darker. A light oblique band, bordered by dark, on posterior part of maxillary. Dorsal with a basal row of 8 large dark brown blotches and a longitudinal dark cloudy band above. Anal, pectorals, ventrals, and caudal yellowish hyaline. Length 200 mm (Typical specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Singapore; Bintang; Biliton; Celebes (Makassar, Bulukomba); Batjan. — Cocos Keeling Islands. In sea.

Note. In a "List of the Opisthognathoid Fishes in the Indian and Western Pacific Oceans" Ogilby (Mem. Queensl. Mus. VII, Part I, 1920, p. 29) gives the distribution of *O. nigromarginatus* Rüppell (= *sonneratii* C. V.) as follows: "Red Sea and Mozambique, Zanzibar Channel through the Seas of India and Malaysia to Celebes and Batchian". I cannot find any record of *nigromarginatus* from the Indo-Australian Archipelago but I suppose that Ogilby considers *castelnaui* as a synonym of *nigromarginatus* on the following grounds: 1. Bleeker described *castelnaui* formerly as "*O. sonneratii?*". 2. *O. castelnaui* does not occur in Ogilby's list. 3. The localities "Celebes and Batchian" are exactly the eastern limits of the distribution of *castelnaui*.

2. **Opisthognathus solorensis** Blkr.

Opisthognathus solorensis Bleeker, Nat. Tijdschr. Ned. Indië V, 1853, p. 81. — Arch. Neerl. Sc. Nat. IX (1873) 1874, p. 471.

D. XI. 14 (15). A. II. 14 (15). P. 2. 16. V. I. 5. Sq. l. about 65.

Height about 5, about 6 in length with caudal. Head 3.3, 3.8 in length with caudal. Eye about 4. Interorbital space concave. Maxillary ending posteriorly in a flexible upturned flap, not reaching to hindborder of opercle. Teeth in jaws conical, pointed, in several rows, the outer row enlarged. Head, nape, back below spinous dorsal, suprascapular and postaxillary region, throat, and breast scaleless. Lateral line ending below anterior part of soft dorsal. Spinous dorsal not much shorter than soft portion, slightly higher posteriorly than in the middle. Soft dorsal posteriorly higher than spinous dorsal, as high as or slightly lower than body. Pectorals about equal to postorbital part of head. Ventrals slightly longer. Anal similar to soft dorsal. Caudal rounded. Colour pinkish green, lighter below. Maxillary posteriorly with a yellow band, margined with brown. Body reticulated with brown. Fins pinkish. Dorsal and anal with a median longitudinal brownish band or the rays variegated with brownish. Spinous dorsal with 1-3 blackish blotches, bordered by margaritaceous. Length 86 mm. (After Bleeker, not seen by me).

Habitat: Solor; Ambon; Goram.

3. **Opisthognathus papuensis** Blkr.

Opisthognathus papuensis Bleeker, Versl. Akad. Amsterdam (2) II (1867) 1868, p. 333.
Gnathypops papuensis Bleeker, Arch. Neerl. Sc. Nat. IX (1873) 1874, p. 473.
Opisthognathus papuensis Günther, Fische der Südsee II, 1876, p. 158.
?*Opisthognathus maculatus* Alleyne & Macleay, Proc. Linn. Soc. New S. Wales I, 1877, p. 280.
?*Gnathypops maculata* Ogilby, Mem. Queensl. Mus. VII, Part 1, 1920, p. 27.
?*Tandya maculata* Whitley, ibid. X, Part 1, 1930, p. 19. — Br. Mus. Great Barrier Reef Exp. Sc. Reports IV, N° 9, 1932, p. 296.

D. XII. 16 (17). A. II. 15 (16). P. 2. 20. V. I. 5. Sq. l. 110-120. L.tr. $\begin{matrix}7\\ 1\\ 38\end{matrix}$.

Height 3.2, 4.3 in length with caudal. Head 2.7, 3.2 in length with caudal. Eye 3.3, much more than snout. Interorbital space concave, 4 in eye. Anterior nostril with a broad somewhat incised tentacle; the posterior one a rounded opening. Maxillary by far not reaching to hindborder of preopercle, truncate behind. Teeth in the jaws in several rows, the outer row enlarged, those of the upper jaw larger than those of the lower jaw. Lateral line ending below posterior half of soft dorsal. Dorsal increasing in height posteriorly. Anal similar to dorsal. Pectorals somewhat less than half length of head. Ventrals pointed, longer than postorbital part of head. Caudal rounded. Pinkish green above, pinkish margaritaceous below. Head, body, tail, dorsal, anal, and pectorals with smaller and larger blackish spots. Length 250 mm. (After Bleeker, not seen by me).

Habitat: Waigeu; Aru Islands?. — Australia? South Sea.

Note. Only two specimens of this species are known: the type, which seems to be lost, as it was not included in the catalogue of the sale of Bleeker's collection after his death, and a specimen in the British Museum, bought with other fishes from the South Sea from a dealer. I think it, however, possible, that *O. maculatus* All. & Macl. is the same species.

4. **Opisthognathus dendriticus** (Jord. & Rich.)

Gnathypops dendritica Jordan & Richardson, Bull. Bur. Fish. XXVII (1907), 1908, p. 261.
Gnathypops dendritica Ogilby, Mem. Queensl. Mus. VII, Part. 1, 1920, p. 29.
Gnathypops dendritica Herre, Journ. Pan Pacif. Res. Inst. VIII, 1933, p. 5.

D. XI. 13. A. II. 13. Sq. l. 105.

Height 3.40. Head 2.66. Eye 3.20. Interorbital space 3.70 in eye. Snout twice in eye. Maxillary 1.33 in head, extending for half its length behind eye. Teeth in bands in both jaws, those in the outer row somewhat enlarged and slightly recurved. Pectorals twice in head, ventrals 1.75. Dorsal inserted over base of pectorals. Anal inserted under eleventh ray of dorsal. Lateral line high, running along back half an eye length from base of dorsal, and terminating over middle of anal; anterior pores of lateral line branched; top and sides of head and predorsal region with numerous, variously connected, branching mucous channels, those immediately in front of the dorsal fin disposed in a tree-like pattern. Colour in spirits light greyish brown with darker brown spots and blotches, these connected in a coarse reticulated pattern on posterior part of trunk and caudal peduncle; scapular region, opercles, and cheeks sparsely sprinkled with coarse black specks; each upper jaw crossed by a broad band of dusky near tip, under which is a dark spot; spinous dorsal with a large squarish black blotch between third and fifth spines, and similar but smaller and fainter spots on the other membranes, near base of fin. Outer edging of spinous dorsal white, above a submarginal zigzag streak of black. Soft dorsal barred lengthwise with dusky just below middle, its outer margin dusky, the middle of the fin and its basal portion pale. Anal marked like soft dorsal. Caudal broadly tipped with blackish and barred crosswise with blackish near base, the middle of the fin pale. Ventrals faintly dusky posteriorly. Pectorals pale, with a faint diffused dusky spot at base. Length 131 mm. (After Jordan & Richardson, not seen by me).

Habitat: Borneo (Sandakan). — Philippines.

Note. Ogilby l.c. says that this species should be carefully compared with *O. darwiniensis* Macl.

5. **Opisthognathus rosenbergi** Blkr.

Opisthognathus Rosenbergii Bleeker, Nat. Tijdschr. Ned Indië XII, 1856, p. 220.

Gnathypops Rosenbergii Bleeker, Arch. Neerl. Sc. Nat. IX (1873) 1874, p. 474.
Opisthognathus rosenbergii Day, Fishes of India, Part II, 1876, p. 267.

D. X. 14 (15). A. II. 13 (14). P. 2. 19. V. I. 5. Ll. 66-69.

Height 4.3-4.6, 5.4 in length with caudal. Head 3.2-3.3, 3.7 in length with caudal. Eye 2.6-2.7. Snout short and blunt, 2.4-2.7 in eye. Interorbital space narrow, about one fourth of eye. Anterior nostril small, with a rim, posterior one a rounded opening. Maxillary truncate behind, not reaching hindborder of preopercle. A row of curved teeth in both jaws, with a band of small, conical, pointed teeth behind it anteriorly, this band tapering backwards and absent on sides of jaws. Lateral line ending below anterior part of soft dorsal. Spinous part of dorsal somewhat lower than soft part, the fin somewhat pointed or slightly rounded behind. Anal similar to dorsal. Pectorals and ventrals subequal, as long as postorbital part of head. Caudal rounded. Colour of preserved specimens brownish. Dorsal with a basal row of 5 large blackish blotches and a broad terminal dark longitudinal band, more distinct posteriorly than anteriorly. Anal with a somewhat wavy basal, and a subterminal longitudinal dark band. Caudal dark brown, with a narrow white posterior edge and a broad white transverse median band. Length about 120 mm. (The type, which is in rather a bad state, and the specimen which Bleeker described afterwards (plesiotype) in the Leiden Museum examined).

Habitat: Singapore!; Nias!. — Coasts of India. In sea.

6. **Opisthognathus moenensis** (Popta)

Gnathypops moenensis Popta, Zoolog. Mededeel. VII, 1922, p. 28.

D. X. 14. A. II. 11. P. 1. 18. 1. V. I. 5. Ll. 80.

Height 5, $6^{1}/_{12}$ in length with caudal. Head $3^{1}/_{3}$, $4^{1}/_{8}$ in length with caudal. Eye 4. Snout $^{1}/_{3}$ of eye. Interorbital space concave, one fourth of eye. Anterior nostril with a flap. Distance from truncate hindborder of maxillary to eye equal to snout and eye. Teeth in the jaws in several rows, the outer row enlarged. Nape scaleless. Spinous portion of dorsal less high than half height of body; the soft portion higher, increasing in height posteriorly and here as high as body. Anal similar to dorsal. Pectorals $^{5}/_{9}$ of head. Ventrals slightly longer. Caudal rounded. Colour of preserved specimens yellowish brown. Anterior part of head with several, posterior part of head with a few black spots. A black blotch on occiput and another on opercle. Fins light leather coloured. Length of single specimen known 73 mm. (After Popta, not seen by me).

Habitat: Muna. In brackish water.

7. **Opisthognathus versluysi** M. Web. (Fig. 10. p. 35)

Opisthognathus Versluysi M. Weber, Siboga Exp. Fische 1913, p. 261.

D. XII. 10. A. II. 10. P. 22. V. I. 5. Sq. l. about 50. Ltr. about 14.

Height 5.5. Head 3.5, broader than long. Eye 3.5, rather superior. Interorbital space very narrow, less than pupil. Snout blunt, much less than eye. Mouth slightly oblique. Maxillary truncate behind, reaching one diameter of eye behind hindborder of eye, by far not reaching hindborder of preopercle. Posterior nostrils close together, round, the anterior ones tentaculated. Scales cycloid, absent on head and nape. Lateral line running along base of dorsal, ending before the middle of a line connecting hindborder of opercle and base of caudal. Dorsal rays slightly increasing in length posteriorly. Anal similar but much shorter than dorsal. Pectorals rounded, as long as postorbital part of head. Ventrals pointed, close together, their bases slightly before those of pectorals, which they equal in length. Caudal rounded. Colour of preserved specimens: Upper part of head, jaws, cheeks, and back brown with lighter marmorations, trunk and tail uniformly light brown. Lower side of head, posterior part of opercle, and belly white. Dorsal with narrow longitudinal dusky bands and a black blotch, bordered with white, between the 3rd to 5th spines. Caudal with dark vertical bands. Pectorals, ventrals, and anal hyaline. Length 36 mm 1).

Habitat: Roma, 20-45 M, on mud and sand!

5. Family URANOSCOPIDAE

Body moderately elongate; head and body somewhat depressed, tail compressed. Small cycloid scales present or absent on body and tail. Belly generally naked. Lateral line single, running high, complete. A short spinous dorsal present or absent. Soft dorsal and anal rather long. Pectorals with a broad base. Ventrals close together, much in advance of pectorals, each with one short spine and 5 rays. Head flat above, scaleless, often covered by bony plates. Eyes superior. Mouth vertical, the lower jaw prominent. Pointed

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1) The length given by Ogilby (Mem. Queensl. Mus. VII, Part I, 1920, p. 30) as 136 mm is a misprint.

teeth generally in several rows on jaws, vomer, and palatines. Two nostrils on each side. Gillmembranes free from the isthmus, 6 branchiostegals, 4 gills. Pseudobranchiae present.

Distribution: Bottom fishes from the Mediterranean and the warmer parts of Indic, Pacific, and Atlantic.

1. **Uranoscopus** Linné

(Linné, Syst. Nat. Ed. Xa, 1758, p. 250)

Elongate, head and body depressed, tail compressed. Head partly covered with bony plates, the surface of which is roughened by many narrow meandering and anastomosing low ridges. Similar ridges on opercular bones. Preopercle with flat radiating ridges, each of them ending in a spine along the lower edge of the bone. Subopercle generally with a spine inferiorly. Preorbital with a more or less developed spine. The suprascapular bony plate also ends in one or two spines. A large humeral spine, more or less directed backwards, always present. Eyes on the upper side of the head. Mouth vertical, large, somewhat protractile. Premaxillaries with a well developed pedicel, reaching to between eyes. A velum behind the dentition of the lower jaw generally well developed. Teeth pointed, in several rows in the jaws, on the vomer, and on the palatines. No scales on head. Scales of body and tail cycloid, small, in very oblique transverse series, the hindborders of those of one row not covering the anterior parts of the scales of the next row. Belly generally without scales. Lateral line ascending in its anterior part, continued closely below base of second dorsal and along upper part of caudal peduncle, with a bent downwards to the middle of the caudal peduncle close to the base of the caudal. Two dorsals, the first short, consisting of III-V flexible spines, the second long and consisting of 12-14 rays, some of the anterior ones unforked. Anal about as long as second dorsal and originating below origin of lastnamed fin. Pectorals long, with a very broad base. Ventrals inserted far forward, consisting of a short spine and 5 rays. A spine directed forward, on the pelvic before the base of the fin. Between the pelvic spines the elongate forward projection of the cleithra forms a symphysial blunt spine, situated somewhat more forward than the pelvic ones. Caudal truncate or slightly rounded. Cleft of the gills wide, separated into a superior and a posterior opening by a broad, more or less fimbriate flap of the opercle. Six branchiostegals. Pseudobranchiae present.

Distribution: Mediterranean, Indic and Western Pacific.

Key to the Indo-Australian species of Uranoscopus

I. No barbel on chin.

A. A spine, directed forwards, at anterior border of preorbital.

a. Sq.l. 73. Five to seven spines along lower edge of preopercle. Humeral spine obliquely directed upwards and backwards. Lips without distinct rows of tentacles . 1. *U. kaianus* p. 42.

b. Sq.l. 55. Four (seldom more) spines along lower edge of preopercle. Humeral spine horizontal. Lips with a row of short fleshy tentacles . . . . 2. *U. bicinctus* p. 43.

c. Sq.l. 57. Four spines along lower edge of preopercle. Humeral spine obliquely directed upwards and backwards. Lower lip with a row of fleshy tentacles . . . . 3. *U. cognatus* p. 44.

d. Sq.l. 54-58. Three (seldom four) spines along lower edge of preopercle. Humeral spine obliquely directed upwards and backwards . . . . 4. *U. japonicus* p. 45.

e. Sq.l. 44-46. Four spines along lower edge of preopercle. Humeral spine obliquely directed upwards and backwards . . . 5. *U. oligolepis* p. 47.

B. Preorbital without distinct spine. Five, seldom six spines along lower edge of preopercle . . . . 6. *U. fuscomaculatus* p. 48.

II. Chin with a long and slender barbel . . . . 7. *U. filibarbis* p. 49.

Doubtful species . . . . 8. *U. papuensis* p. 49.

1. **Uranoscopus kaianus** Gthr.

Uranoscopus kaianus Günther, Rep. Challenger Exp. Zool. Part VI, 1880, p. 43.

Uranoscopus kaianus M. Weber, Siboga Exp. Fische 1913, p. 521 (pro parte).

D1. III. D2. 3. 10. A. 13. (14). P. 17-19. V. I. 5. Ll. 73. Ltr. $\begin{array}{c}6\text{-}7\\ \hline 1\\ \hline 26\text{-}29\end{array}$.

Height 4.6-4.8, 5.7-5.8 in length with caudal. Head 2.7-2.8, 3.3-3.4 in length with caudal. Breadth of head 1.3 in its length. Eye 7.3-8.6, 2-2.2 in snout and 1.4-1.7 in flat interorbital space. Bony plates of head and of opercular bones rugose. Preorbital anteriorly with a spine. Five to seven short spines along lower border of preopercle and one spine on lower border of subopercle. Suprascapular bony plate posteriorly with a single spine, directed backwards. Humeral spine directed obliquely upwards and backwards, twice as long as eye or somewhat shorter. Lips without distinct tentacles. A few rows of pointed teeth in the upper jaw and a single row of much stronger ones in the lower jaw. Vomer with a transverse band of pointed teeth. A patch of somewhat larger teeth on anterior part of palatines. Height of first dorsal about two thirds of interorbital space. Third ray of second dorsal longest, about three fourths of postorbital part of head. Following rays rapidly decreasing in length posteriorly. The last ray equal to eye. Origin of anal below that of second dorsal, end of anal slightly behind that of dorsal. Posterior anal rays slightly longer than anterior ones, about one eye diameter longer than interorbital space. Pectorals about as long as head without snout. Ventrals twice in head. Pelvic spines below or slightly behind antero-inferior edge of maxillary. Colour of preserved specimens brownish above, whitish below. Upper part of head and back reticulated with narrow dark brown anastomosing lines. First dorsal black, second dorsal, anal, caudal, and ventrals yellowish. Pectorals dusky or blackish in their basal half, otherwise yellowish. Length 250 mm.

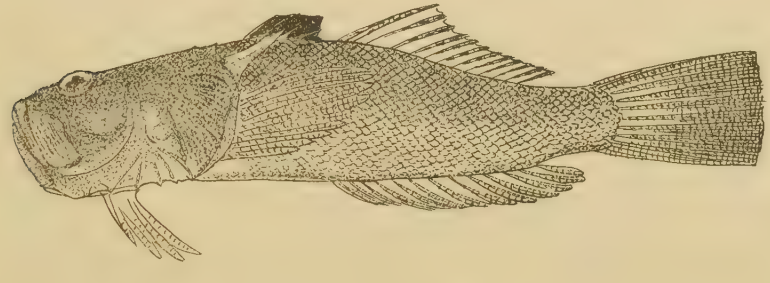

Fig. 11. *Uranoscopus oligolepis* Blkr. × $^2/_3$.

Habitat: Arafura Sea, 50-304 M!; off Kei Islands, 252 M.

2. **Uranoscopus bicinctus** Schl.

Uranoscopus bicinctus Schlegel, Fauna Japonica, Pisces, 1850, p. 26.
Uranoscopus laevis Bleeker, Acta Soc. Sc. Indo-Neerl. I, 1856. Beschr. vischs. Amboina p. 74 (errore, nec Bl. Schn.).
Uranoscopus bicinctus Bleeker, ibid. II, 1857. Achtste bijdr. vischf. Amboina, p. 41.
Uranoscopus bicinctus Günther, Cat. Brit. Mus. II, 1860, p. 228.
Uranoscopus bicinctus Bleeker, Versl. Akad. Amsterdam (2) XIII, (1877) 1878, p. 51.
Uranoscopus bicinctus Steindachner & Döderlein, Denkschr. Akad. Wien XLIX, 1884, p. 189.

Uranoscopus bicinctus Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV, 1902, p. 476.
Uranoscopus bicinctus Franz, Abh. Bayer. Akad. Wiss. Suppl. Band IV, 1910, p. 83.
Uranoscopus bicinctus Umali, Philipp. Journ. Sc. LVI, 1935, p. 321.

D^1. III. D^2. 1. 11 (12). A. 13. P. 17. V. I. 5. Ll. 55. Ltr. $\begin{matrix}4\\1\\25\end{matrix}$.

Height 4.4, 5.5 in length with caudal. Head 2.3, 2.9 in length with caudal. Breadth of head 1.4 in its length. Eye 8.4, 1.5 in snout and 1.7 in slightly convex interorbital space. Bony plates of head and opercular bones rugose, pitted. Preorbital anteriorly with a spine. Preopercle with 4 spines along its lower border, subopercle with one spine. Suprascapular bony plate with a longer outer spine, directed backwards and a smaller inner one, directed inwards. Humeral spine horizontal, about twice eye. Lips with a row of short fleshy tentacles. A few rows of rather strong pointed teeth in the jaws. An elongate transverse patch of similar teeth on the vomer, and a small patch on anterior part of palatines. Longest spine of first dorsal equal to interorbital space. Third ray of second dorsal longest, equal to distance between hindborder of eye and suprascapular spine. Rays rapidly decreasing in length posteriorly, the last ray equal to interorbital space. Origin of anal below that of second dorsal, both fins of equal length. Posterior anal rays slightly longer than anterior ones, and slightly more than interorbital space. Pectorals as long as postorbital part of head, ventrals twice in head. Pelvic spines behind vertical through antero-inferior edge of maxillary. Caudal truncate. Colour of preserved specimen brownish above, light below. Sides of head dotted with dark. A dark saddle on back behind head and below posterior part of second dorsal. First dorsal black, second dorsal hyaline, the rays dusky, darker distally and tipped with white. Anal dusky, white distally. Pectorals and caudal dark, freckled with black and edged with white. Ventrals dusky. Length 251 mm (A specimen of Bleeker's collection in the Amsterdam Museum examined).

Habitat: Ambon!; Aru Islands. — Japan, China, Riu Kiu Islands, Philippines. In sea.

3. **Uranoscopus cognatus** Cant.

Uranoscopus cognatus Cantor, Journ. Asiat. Soc. Bengal XVIII, Part II, 1850, p. 1003.
Uranoscopus cognatus Günther, Cat. Brit. Mus. II, 1860, p. 227.
Uranoscopus cognatus Bleeker, Acta Soc. Sc. Indo-Neerl. VIII. 1860.

Twaalfde bijdr. vischf. Amboina, p. 3. — Versl. Akad. Amsterdam (2) XIII, 1878, p. 49.

Uranoscopus cognatus Alcock, Journ. Asiat. Soc. Bengal LVIII, 1889, p. 301.

Uranoscopus kaianus M. Weber, Siboga Exp. Fische 1913, p. 521 (pro parte).

D¹. III. D². 14 (15). A. 13 (14). P. 17. V. I. 5. Ll. 57. Ltr. circa 25.

Height 4, 5.1 in length with caudal. Head 2.4, 3.1 in length with caudal. Breadth of head 1.3 in its length. Eye 7.1, 1.4 in snout and 1.1 in scarcely convex interorbital space. Bony plates of head rugose. Preorbital anteriorly with a spine. Four, seldom five spines along the lower border of the preopercle. Subopercle with one spine. Suprascapular bony plate posteriorly with a longer outer and a much shorter inner spine. Humeral spine obliquely directed upwards and backwards, twice as long as eye. Lower lip with a row of fleshy tentacles, upper lip with much shorter filaments. A few rows of rather strong teeth in the jaws. Vomer with a transverse patch of similar teeth, those on palatines somewhat stronger. Longest spine of first dorsal equal to interorbital space. Third or fourth ray of second dorsal longest, equal to distance between hindborder of eye and base of suprascapular spine. Rays of second dorsal rapidly decreasing in length posteriorly, the last ray about one half diameter of eye. Origin of anal below origin of dorsal, end of anal below end of dorsal. Posterior anal rays slightly longer than the anterior ones and about equal to snout and eye. Pectorals equal to head without snout, ventrals equal to postorbital part of head. Pelvic spines behind vertical through antero-inferior edge of maxillary. Caudal slightly rounded. Colour of preserved specimens brown above, light below. Back with or without small dark brown reticulations. Sides of head, of anterior part of body, and belly with numerous small dark spots, which may also be present on upper side of head and back. First dorsal black, the first spine more or less white. Rays of second dorsal with dusky bars. Pectorals and caudal covered with small dark points, the lower and hinder edges of both fins white. Anal and ventrals white or with dark spots. Length 270 mm.

Habitat: Singapore; Saleh Bay, Sumbawa, 274 M!; Ambon!; — Pinang, East Coast of Johore, Bay of Bengal. In sea.

4. **Uranoscopus japonicus** Houttuyn

Uranoscopus japonicus Houttuyn, Verh. Holl. Maatsch. Wetensch. Haarlem, 1782, p. 311.

Uranoscopus asper Schlegel, Fauna Japonica, Pisces, 1850, p. 26.

Uranoscopus asper Bleeker, Verh. Bat. Gen. XXVI. 1854-1857. Nieuwe Nalez. Ichth. Japan, p. 66.

Uranoscopus asper Brevoort, U. S. Japan Exp. Nat. Hist. Washington. 1856. p. 259.

Uranoscopus asper Günther, Cat. Brit. Mus. II, 1860, p. 228.

Uranoscopus asper Bleeker, Nat. Tijdschr. Ned. Indië XXI, 1860, p. 140. — Versl. Akad. Amsterdam (2) XIII, 1878, p. 53.

Uranoscopus asper Steindachner & Döderlein, Denkschr. Akad. Wien XLIX. 1. Abth. 1885, p. 189.

Uranoscopus japonicus Jordan & Snyder, Proc. U. S. Nat. Mus. XXIII, 1901, p. 745. — ibid. XXIV (1901) 1902, p. 475.

Uranoscopus japonicus Franz, Abh. math. phys. Kl. K. Bayer. Akad. Wiss. IV. Suppl. Bd. 1. Abth. 1910, p. 83.

Uranoscopus japonicus Evermann & Shaw, Proc. Calif. Acad. Sc. (4) XVI, 1927, p. 121.

Uranoscopus japonicus Wu, Sinensia I, 1931, p. 174.

Uranoscopus japonicus Umali, Philip. Journ. Sc. LVI, 1935, p. 320.

D^1. IV-V. D^2. 14-15. A. 14-15. P. 1. 17-18. V. I. 5. Ll. 54-58.

Height 4.3-4.5, 5.5-6 in length with caudal. Head 3.8, 4-4.6 in length with caudal. Eye 4.5-5, about equal to interorbital space. Preorbital with a blunt spine. Top and sides of head with moderately rugose bony plates. Three, seldom four divergent spines along lower border of preopercle; a larger spine on subopercle. Suprascapular bony plate posteriorly with two spines, the posterior one much longer than the anterior. Humeral spine more than twice diameter of eye, obliquely directed upwards and backwards. Teeth in upper jaw anteriorly in 3-5 rows, posteriorly in one or two rows; in lower jaw in 2-3 rows anteriorly and in one or two rows posteriorly, the posterior teeth longer than the others. Teeth on vomer and palatines in four patches, forming a curved band, the patches on vomer longer than those on palatines. Dorsals contiguous or subcontiguous. Spinous dorsal much lower than second dorsal, the first and second spines longer than the others. Second dorsal emarginate, the anterior rays about twice as long as the posterior ones. Anal slightly longer and much lower than second dorsal, deeper posteriorly than anteriorly. Pectorals scarcely shorter than head. Ventrals about equal to postorbital part of head. Caudal slightly rounded. Dark above, light below. Upper side with irregular light smaller and larger blotches, those on head much smaller than those on body. Spinous dorsal black, white at tips and at base of anterior spines. Other fins dusky. Length 290 mm (Compiled, not seen by me).

Habitat: Singapore; Banka; Ambon. — Coasts of China, Riu Kiu Islands, Japan, Philippines. In sea.

5. **Uranoscopus oligolepis** Blkr (Fig. 11, p. 43)

Uranoscopus asper Bleeker. Verh. Bat. Gen. XXV, 1853. Nalezingen ichth. Japan, p. 27 (nec Schl.).
Uranoscopus oligolepis Bleeker, Versl. Akad. Amsterdam (2) XIII, 1878, p. 49, p. 55.
Uranoscopus oligolepis Franz, Abh. Bayer. Akad. Wiss. Suppl. Band IV, 1. Abth. 1910, p. 83.
Uranoscopus kaianus M. Weber, Siboga Exp. Fische 1913, p. 521 (pro parte).

D^1. III. D^2. 2. 11. A. 13 (14). P. 17-18. V. I. 5. L.l. 44-46.
Ltr. $\begin{array}{c}6\text{-}7\\\hline 1\\\hline 23\text{-}24\end{array}$.

Height 3.9, 4.8-4.9 in length with caudal. Head 2.6-2.7, 3.3-3.4 in length with caudal. Breadth of head 1.2-1.3 in its length. Eye 5-6.5, 1.2-1.6 in snout and 1-1.2 in scarcely concave interorbital space. Bony plates of head and opercular bones finely rugose. Preorbital with a spine anteriorly. Preopercle with 4 spines along its lower edge; subopercle with one spine. Suprascapular bony plate posteriorly with a short interior and a longer exterior spine. Humeral spine directed obliquely upwards and backwards, almost twice diameter of eye or somewhat shorter. Lower lip with a row of fleshy tentacles. A few rows of rather strong teeth in the jaws, the posterior ones near symphysis somewhat longer. Vomerine teeth in two patches, teeth on anterior part of palatines stronger than those of vomer. Longest spine of first dorsal about equal to interorbital space. Third ray of second dorsal longest, equal to distance between hindborder of eye and base of suprascapular spines. Rays rapidly decreasing in length posteriorly, the last ray equal to eye or slightly shorter. Origin of anal slightly before that of second dorsal, its end slightly behind that of second dorsal. Posterior anal rays slightly longer than anterior ones, much shorter than longest rays of dorsal. Pectorals equal to head without snout or somewhat shorter. Ventrals twice in head. Pelvic spines below or behind antero-inferior edge of maxillary. Caudal slightly rounded. Colour of preserved specimens brownish above, whitish or margaritaceous below. First dorsal black. Pectorals and caudal dusky, the lower border of both fins creamy white. Second dorsal dusky. Anal and ventrals whitish. Length 185 mm.

Habitat: Sumatra; Java; Ambon; Strait Solor, 247 M! — Riu Kiu Islands, Japan. In sea.

6. **Uranoscopus fuscomaculatus** Kner

Uranoscopus fuscomaculatus Kner, Sitzber. Akad. Wien LVIII, 1868, p. 28. — ibid. p. 319.

Uranoscopus fuscomaculatus Günther, Fische der Südsee II, 1876, p. 157. — Challenger Exp. Zool. VI, 1880, p. 43.

D^1. III. D^2. 13. A. 13. P. 18-19. V. 6.

Head 4 in total length, its breadth between the opercles about three fourths of its length. Eye 6. Lower jaw with a single row of rather strong curved teeth, upper jaw with a double row of somewhat feebler teeth. Vomer with a transverse villiform band. Palatines with a short single row of curved pointed teeth. Lips thin, fimbriated. Preorbital and suborbitals without distinct spines. Surface of opercle and preopercle with numerous little furrows and granular ridges; these ridges diverging radially on preopercle and produced beyond its lower border as 5 or 6 short spines. Humeral spine two fifths length of pectoral, strongly furrowed lengthwise. Dorsal spines flexible, rapidly decreasing in length posteriorly, the first one half as long as the third and fourth rays of the second dorsal, which are the longest rays in the vertical fins, excepting those of the truncate caudal. The median rays of the pectoral are also longer. Lateral line running close to back and to base of dorsals, bent downwards immediately before caudal and produced along the median line of that fin to its hindborder. First dorsal black, white at base of first spine. Second dorsal greyish hyaline, with dark brown spots along the rays. Other fins similar, but caudal, and pectorals almost uniformly blackish brown with broad white edges, which are also present on the pale anal and especially on the ventrals. Head light brown, without spots. Back dark brown, with 2-3 longitudinal rows of smaller or larger dark brown blotches, from occiput to caudal. Along the sides a few irregular rows of similar blotches up to the size of mere points. Lower side whitish, without spots. Length 167 mm. (Compiled, not seen by me).

Habitat: Arafura Sea. — Fiji.

Note. Fowler (Mem. B. P. Bishop Mus. X, 1928, p. 427) has united this species with *U. sulphureus* C. V. In this incompletely described species the preorbital spines are also wanting, there are 5 preopercular spines, 13 rays in the second dorsal and 13 rays in the anal. All this agrees with *fuscomaculatus*. The first dorsal of *sulphureus* has however 5 spines. U. *sulphureus* has the head sulphur yellow, the rest of the fish was discoloured. Fowler is probably right in uniting the two, but re-examination of the type is necessary.

7. **Uranoscopus filibarbis** C. V.

Uranoscopus filibarbis Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 307.
Uranoscopus filibarbis Von Martens, Preuss. Exp. Ost-Asien. Zool. Theil I, 1876, p. 389.

D¹. IV. D². 14. A. 13. P. 17. V. I. 5.

A long slender filament below symphysis of lower jaw. Four preopercular spines. First dorsal black.

Habitat: Ambon. — Indian Ocean.

Note. The French authors described this species very incompletely. It has not been redescribed since, and Von Martens l.c. is the only one who mentions this species again, without giving a description. His specimen came from Ambon. Re-examination of the type and of Von Martens' specimen is necessary.

Doubtful species

8. **Uranoscopus papuensis** Blkr

Jordan & Seale (Bull. Bur. Fish. XXV (1905) 1906, p. 414) record this species without any references. The habitat given is Waigeu. I have not been able to find a description of this species. Probably some mistake has been made and I suppose that the authors meant *Opisthognathus papuensis,* which species Bleeker described from Waigeu.

Doubtful genus and species.

Kathetostoma malacopterus (Benn.).

Uranoscopus malacopterus Bennett, in "Life of Raffles", 1830, p. 687.
Katethostoma malacopterus Bleeker, Versl. Akad. Amsterdam (2) XIII, 1878. p. 59.

Bennett described this species from the West Coast of Sumatra as an *Uranoscopus* with a single scarcely spinous dorsal, which is longer than the anal. The pectorals are rounded and scarcely reach the dorsal.

Bleeker was of opinion that it belongs to the genus *Kathetostoma* from Australia, New Zealand and the East Pacific. It is characterized by having a single dorsal and no scales, and as Bennett does not mention this last item it seems doubtful if Bleeker was right. It seems more probable that it belongs to the genus *Ichthyoscopus*, which also has a single dorsal but where the body is scaled. It may be a synonym of *Ichthyoscopus lebeck* (Bl. Schn.) which species is known from the Coasts of India, Japan, and Australia and which may be supposed to occur in the Indo-Australian Archipelago.

7. Division CALLIONYMIFORMES

Head and body depressed, tail compressed, or head and body more or less cylindrical. No scales. Lateral line single, complete, those of both sides generally connected by transverse branches on nape and on back of caudal peduncle. Two dorsals, a short one with II or IV spines and a longer one with soft simple or branched rays. Anal moderate, shorter than second dorsal. Ventrals inserted before pectorals, widely separated, large, with a very short spine and 5 soft rays, the last ray often connected by a membrane to the skin at base of pectorals. Pectorals large, rounded. Mouth protractile, small, horizontal or nearly so. Gillmembranes totally joined to the isthmus. Skin of opercle also joined to that of the shoulder girdle and the gillopenings therefore reduced to a small slit near the superior part of the opercle. Preopercle with a well developed bony process, covered by skin, at its posterior angle. This spine either with a spine anteriorly at its base or without such a spine. One or more spines at its extremity or along its upper border. Pointed teeth in several rows in the jaws, none on the palate. Vertebrate few, 21 in number.

1. Family CALLIONYMIDAE

For characters of the family see those of the division 1).

Distribution. Temperate and warm parts of Atlantic in the Northern Hemisphere, Indic, and Pacific, but not known from the Pacific Coasts of America.

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1) The family Draconettidae is not represented in the Indo-Australian Archipelago and is therefore left out of consideration in the diagnosis of the division. It differs from the Callionymidae by the absence of the preorbital spine and the opercle and subopercle are reduced to spines.

Key to the Indo-Australian genera of Callionymidae

I. Spine and first ray of ventrals not separated from rest of fin.
  A. Branchial openings on upper surface of head. Preopercular process with a spine at its base, directed forwards. Head and body depressed or much depressed. Last ray of ventrals united by membranes with base of pectoral . . . . 1. *Callionymus* p. 51.
  B. Branchial openings lateral, looking more or less backwards.
    a. Preopercular process with a spine at its base directed anteriorly. Head and body depressed. Last ray of ventrals united by membrane to base of pectoral . . . 2. *Diplogrammus* p. 68.
    b. Preopecular process without such a spine.
      a. Last ray of ventral connected by membrane to the base of the pectoral. Body more or less cylindrical. Opercle without free flap . . . . 3. *Synchiropus* p. 70.
      b. Last ray of ventral not connected by membrane to the base of the pectoral. Opercle with a long pointed flap.
        a^1. First dorsal much nearer snout than base of caudal. Body elongate 4. *Eleutherochir* p. 76.
        b^1. First dorsal midway between snout and base of caudal. Body short . 5. *Brachycallionymus* p. 79.
II. Spine and first ray of ventrals separated from the rest of the fin, the last ray of which is connected by membrane to the base of the pectoral. Gillopenings reduced to a small slit behind opercle . . . . 6. *Dactylopus* p. 79.

Callionymus Linné

(Linné, Syst. Nat. Ed. X, Vol. I, 1758, p. 249)

Calliurichthys Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1903, p. 941.
Repomucenus Whitley, Austr. Zool. VI, Part IV, 1931, p. 323.

Head and body depressed. Preopercular process with an antrorse spine. Branchial opening small, on upper surface of head. First dorsal with III or IV spines, second dorsal with 9-11 rays. Anal short. Last ray of ventrals connected by membrane to the base of the pectoral. Caudal rounded or pointed.

Distribution: Atlantic, Indic, and West-Pacific.

Key to the Indo-Australian species of Callionymus

A. Preopercular process slender, straight, tapering into a point behind. The inner side with a series of barb-like serrulations, inserted at a very sharp angle on the process and directed anteriorly.
- *a.* Anal with 8 (9) rays. A smooth area behind eyes, flanked by two bony conical ridged tubercles . . . . 1. *C. japonicus* p. 52.
- *b.* Anal with 8 (9 rays). A rugose area behind eyes . . . . 2. *C. scabriceps* p. 55.
- *c.* Anal with 7 (8) rays. A rugose area behind eyes . . . . 3. *C. variegatus* p. 56.
- *d.* Anal with 9 (10) rays. A smooth area behind eyes, with a rugose area covered by skin on each side . . . . 4. *C. filamentosus* p. 57.

B. Preopercular process strong, robust, ending in a curved spine and with more or less hooked, thorn-like teeth, three or more in number. A. 9-10.
- *a.* First dorsal much higher than second one, not black, some of the rays prolonged.
  - a^1. Preopercular process curved with 4-5 teeth. Eye 3-3.1, separated by a narrow interorbital space . . . . 5. *O. schaapi* p. 59.
  - b^1. Preopercular process straight with 4-6 teeth. Eyes 2.5-2.6, contiguous . . . . 6. *C. annulatus* p. 60.
  - c^1. Preopercular process straight, with 3-4 teeth. Eyes 2.7-3, contiguous . . . . 7. *C. leucobranchialis* p. 61.
- *b.* First dorsal without prolonged rays and partly or totally black.
  - a^1. First dorsal twice as high as body, its first spine about equal to snout and eye 8. *C. melanotopterus* p. 62.
  - b^1. First dorsal as high as body, its first spine shorter than eye . . . . 9. *C. sagitta* p. 63.

C. Preopercular process shorter and tricuspid posteriorly.
- *a.* 7-8 anal rays.
  - a^1. Interorbital space one fourth of eye. P. 17-18 . . . . 10. *C. enneactis* p. 64.
  - b^1. Interorbital space a narrow ridge, much less than pupil . . . . 11. *C. willburni* p. 65.
- *b.* 9 anal rays . . . . 12. *C. kaianus* p. 66.

D. Preopercular process bifid. A. 7. A small tentacle above each eye. . . . . 13. *C. tentaculatus* p. 67.

1. **Callionymus japonicus** Houttuyn

Callionymus japonicus Houttuyn, Verh. Holl. Maatsch. Wet. Haarlem XX, 1782, p. 311.

Callionymus reevesii Richardson, Voy. Sulphur, Fishes, 1844, p. 60.
Callionymus longicaudatus Schlegel, Fauna Japonica, Pisces, 1850, p. 151.
Callionymus Reevesii Bleeker, Nat. Tijdschr. Ned. Indië V, 1853, p. 244. — Acta Soc. Sc. Indo-Neerl. III, 1858. Vierde bijdr. ichth. Japan, p. 19.
Callionymus longecaudatus Günther, Cat. Brit. Mus. III, 1861, p. 148 (partim).
?*Callionymus longicaudatus* Day, Fishes of India, Part II, 1876, p. 322.
Callionymus Belcheri Bleeker, Versl. Akad. Amsterdam (2) XIV (1877), 1879, p. 85 (nec Rich.?).
?*Callionymus longicaudatus* Tirant, Bull. Soc. Etudes Indochin. 1883. Reprinted: Service Océan. Indochine. 6° note. 1929, p. 20.
Calliurichthys japonicus Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1903, p. 942.
Callionymus longicaudatus M. Weber, Siboga Exp. Fische 1913, p. 525.
Callionymus, Calliurichthys, japonicus Mc Culloch, Rec. Austr. Mus. XIV, N° 1, 1923, p. 7, p. 8. — Fisheries, Biol. Res. Endeavour V, Part 4, 1926, p. 196.
?*Calliurichthys linea-thorax* Fowler, Bull. U. S. Nat. Mus. 100. Vol. 14, part 2, 1943. p. 80.
?*Callionymus longicaudatus* Blegvad, Fish. Iran. Gulf. Danish Sc. Inv. Iran, Part III, 1944, p. 174.

D^1. IV. D^2. 9 (10). A. 8 (9). P. 20. V. I. 5.

Height 9.7-10.7, 13.5-16 in length with caudal. Head, measured from branchial openings to tip of snout, 3.2-4.8, 4.5-7.5 in length with caudal. Breadth of head 1.05-1.1 in its length, measured as above. Eyes 3-3.1, somewhat less than snout, contiguous, the interorbital space forming a somewhat elevated sharp bony ridge. A smooth area behind eyes, flanked at both sides by a more or less conical rugose bony protuberance, which also more or less extends to behind the smooth area. Mouth horizontal. Maxillary not quite reaching to below frontborder of eye. A few rows of pointed teeth in the jaws. Preopercular process slender, almost straight, with a slender spine anteriorly; tapering to a sharp point posteriorly and with about 7 or 8 barbs, pointing anteriorly, along its inner border. Branchialopenings one eye diameter behind eyes, behind the bony protuberances mentioned above, their distance equal to that of the outer borders of the eyes. Lateral line beginning close and slightly before the inner border of the branchial opening. The lateral lines of both sides connected by a transverse canal, running along the hind borders of the bony protuberances. The lateral lines are continued forwards along the outer sides of these protuberances, bifurcating here, one branch running outwards and downwards along opercle near posterior border of preopercle, and the other continued forwards and ending below posterior part of eye. In Japanese specimens the branch on opercle bifurcates again, but this is not the case in specimens from the Indo-Australian Archipelago. Posteriorly the lateral lines are connected by two parallel branches, running over the back of the caudal peduncle. First and second dorsal spines close together, about as long as snout and eye, produced into filaments in males. First ray of second dorsal slightly less, last dorsal ray somewhat more, than first spine. The anterior branch of the last ray is bifurcated at tip, but the posterior branch (or 9th ray as counted by Bleeker) is simple. First anal ray equal to eye or somewhat longer, following rays increasing in length to the last, which equals the last dorsal ray. All anal rays simple. Pectorals as lang as snout and eye. Ventrals longer, equal to postorbital part of head, measured to hindborder of opercle. Caudal very long, pointed. Colour of preserved specimens pinkish above, with numerous light brown and white spots and stripes, the white ones bordered by narrow brown lines, the brown ones forming more or less distinct rows along the sides, between dorsal and anal and on caudal peduncle. Small light purple spots on opercle, arranged in a band which runs obliquely backwards on the inferior part of the bone. Pupil and a few spots below eye of the same colour. Lower side of head and of body whitish, that of tail creamy or light brown. First dorsal freckled, dusky and whitish, last colour more or less arranged in oblique bars. A large black spot between the first and second spines superiorly. Second dorsal hyaline with about 3 longitudinal rows of dark spots. Anal white at base, brown distally, the rays white and hence forming a white interrupted outer border to the fin, the membranes of which are deeply incised. Caudal whitish with a dusky lower border, and transverse rows of rather large dark spots in its upper half. Pectorals hyaline, ventrals white, with light brown transverse rows of spots and longitudinal streaks of light purple along the rays. Length 310 mm.

Habitat: Singapore; Celebes (Makassar); Sulu Islands?; Buru; Ceram; Ambon; near Walgeu, 59-85 M, sandbottom!; South of New Guinea. — Zanzibar?, Iranian Gulf?, Coasts of India, Annam?, China, Japan, Riu Kiu Islands, Philippines, Coast of Queensland, Lord Howe Island. In sea.

Note. I am not quite sure if the Indo-Australian specimens described here belong to *japonicus*. Bleeker l.c. 1879 gives as differences that in typical *japonicus* from Japan the branch of the lateral line on the opercle bifurcates as described above and that the dark blotch on the first dorsal is placed more anteriorly, between the third and fourth spines. I can conform these statements and

I am inclined to treat the Indo-Australian specimens as a subspecies of *japonicus* but I am in doubt what name to give it. Bleeker ranged his specimens as *belcheri* Rich. but without re-examination of the type. I am not convinced that he is right. The elaborate description of *belcheri* given by McCulloch (Fisheries, Biol. Res. Endeavour, V, Part 4, 1926, p. 199) based on specimens from Queensland, are not in favour of Bleeker's view.

Calliurichthys linea-thorax Fowler may be the same species. The chief difference being the coloration of the underside: "the branchiostegal and prepectoral region with many parallel close-set longitudinal bands, separated on chest and throat by a large blackish triangular blotch" (Fowler).

2. **Callionymus scabriceps** Fowler

Callionymus scabriceps Fowler, Proc. U. S. Nat. Mus. Vol. 90, N° 3106, 1941, p. 4.

D^1. IV. D^2. 9 (10). A. 8 (9). P. 19. V. I. 5.

Depth 6. Head $3^4/_5$, length $1^1/_{10}$ in width. Snout $2^2/_3$ in head. Eye $2^4/_5$, subequal with snout, well protruded on upper profile of head. Maxillary reaches three-fourths to eye, entire. Mouth cleft reaches halfway to eye. Upper jaw greatly protractile and mandible shorter or included in upperjaw. Teeth very fine, minute, villiform, in narrow bands in jaws. No interorbital space, eyes closely set in apposition. Preopercular process long, slender, greater than orbit, inner edge with eight antrorse spines, and a small spine at front of base directed forward. Lateral line elevated, high along side of back, complete. Along and above course of lateral line four short vertical bars of papillae or pores, last over caudal peduncle before caudal base. Parietal region of head with striate rugae, rather coarse and irregular. First dorsal spine $1^1/_8$ in head, first ray of second dorsal $1^1/_3$; first ray of anal $2^1/_2$. Caudal $2^1/_3$ in rest of fish, cuneate. Least depth of caudal peduncle 4 in head. Pectorals as long as head. Ventrals 3 in fish without caudal. Colour in alcohol: back brown, with six darker saddlelike cross bands, though ill-defined and more or less obscured by paler rings or blotches, the various shades producing more or less mottled appearance above. Dark brown blotches also on sides of head and prepectoral region. Undersurface of body uniform whitish. First dorsal with dark brown spots, obscurely ocellated with paler and with some irregular white spots on last two membranes. Second dorsal transparent, with three and sometimes four longitudinal rows of black ocelli, subbasal and median series most contrasted. Anal with rays tipped white and submarginally dark brown, shading paler basally on fin; caudal transparent, with eight transverse dark brown bands on lower two thirds of fin, and in each band brownish black spot, only distinct as fin is expanded. Pectoral largely colourless. Ventral variegated with brown, as pale to whitish spots, producing a mottled appearance. Length 58 mm. (After Fowler, not seen by me).

Habitat: Sulu Islands. — Philippines.

3. **Callionymus variegatus** Schl.

Callionymus variegatus Schlegel, Fauna Japonica, Pisces, 1850, p. 153..
Calliurichthys variegatus Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1903, p. 944.
Calliurichthys variegatus Jordan, Tanaka & Snyder, Journ. Coll. Sc. Univ. Tokyo XXXIII, Art. 1, 1913, p. 373.
Callionymus Cooki, M. Weber, Siboga Exp. Fische 1913, p. 524 (nec Gthr.).

D^1. IV. D^2. 8 (9). A. 7 (8). P. 15. V. I. 5.

Height 8.4, 10.9 in length with caudal. Head measured from gillopenings to tip of snout 3.4, 4.4 in length with caudal. Breadth of head 1.1 in its length, measured as above. Eyes 3.7, 1.5 in snout, almost contiguous, the interorbital space being very narrow and with a shallow groove. An oval rugose area immediately behind the eyes. Mouth horizontal. Upper jaw not totally covered by preorbital, when the mouth is closed. Lower jaw included. Maxillary reaching to below frontborder of eye. A narrow band of villiform teeth in both jaws. Preopercular process slender and almost straight, with a slender spine in front, directed anteriorly; tapering to a sharp point posteriorly and with about 8 short and slender spines, directed anteriorly and barb-like. Branchial openings immediately behind the oval rugose plate mentioned above, one eye diameter behind eye; their distance more than that of the outer borders of the eyes. Lateral line beginning near the inner border of the branchial opening; the lateral lines of both sides connected by a branch, running along the posterior border of the rugose plate and continued anteriorly along the outer borders of that plate to below eye. Posteriorly the lateral lines are continued on the caudal and they are connected by a branch over the back of the caudal peduncle. First dorsal spine with a long filament, reaching almost to the end of the second dorsal when depressed. Second spine somewhat less than snout, following ones gradually decreasing in length. All dorsal rays simple, excepting the last, which is by far the longest, reaching to base of caudal and equal to snout and eye together. Anal rays simple excepting the last, which is longest and slightly less than last dorsal ray. Pectorals slightly shorter than ventrals, equal to distance between base of preopercular process and tip of snout. Caudal pointed. Colour of preserved specimen light reddish brown, lower side of head and thorax paler. Rugose plate on nape pinkish. Back and upper side of tail with irregular light patches. A row of brown blotches along sides of body and tail. A number of cross bars on back below second dorsal, one below origin and one below end of the fin more distinct than the others. Cheeks and opercle with brown stripes, radiating from eye. Second dorsal with faint brown spots, first dorsal and anal without markings. Median part of caudal with rather large brown spots. A few brown spots on basal part of last ventral rays. These fins otherwise as well as pectorals without markings. Length of the specimen described 49 mm. Attains over 160 mm.

Habitat: Kei Islands! — Japan.

Note. M. Weber labelled this specimen with some doubt as *C. cooki.* It differs, however, from this species by the form of its preopercular process, which has a slender but well developed antrorse spine at its anterior end. The serrations on the inner side of the bone are also different, being barb-like serrulations, the point directed anteriorly and very different from those as figured by Günther for *cooki.* It agrees with the description of *C. variegatus* Schl., excepting some minor details of coloration, which may be due to the young age of the specimen.

4. **Callionymus filamentosus** C. V.

Callionymus filamentosus Cuvier & Valenciennes, Hist. Nat. Poissons XII, 1837, p. 303.
Callionymus filamentosus Bleeker, Nat. Tijdschr. Ned. Indië II, 1852, p. 278.
Callionymus filamentosus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 485.
?*Callionymus longicaudatus* Day, Fishes of India, Part II, 1876, p. 322.
Callionymus filamentosus Herre, Philipp. Journ. Sc. LIX, 1936, p. 369.
Callionymus longi Fowler, Proc. U. S. Nat. Mus. XC, 1941, p. 10.

D^1. IV. D^2. 9 (10). A. 9 (10). P. 18. V. I. 5.

Height 7.5-9.5, 9.7-12.1 in length with caudal. Head measured from gillopenings to tip of snout 3.7-4, 4.8-5.2 in length with caudal. Length of head, measured as above, 1-1.1 in its breadth. Eyes 2.8-3.3, 1-1.2 in snout, contiguous, the interorbital space forming a rather sharp bony ridge. A smooth area behind eye, surrounded laterally and posteriorly by a rugose, more or less ridged or honey combed bony area, covered by thin skin. Mouth horizontal, lower jaw included. Maxillary not quite reaching to below frontborder of eye. Preopercular process nearly straight, with a spine anteriorly, tapering in a point posteriorly and with 4-6 rather coarse barbs along its inner side, the barbs directed anteriorly. Branchial openings one eye diameter behind eye, their distance equal to the distance between outer borders of eyes. Lateral lines of both sides beginning close to the inner side of the branchial openings, connected here by a transverse branch, and continued forwards as a branch, which bifurcates behind eye, one branch running downwards and bifurcating again in a preopercular and an opercular branch; the other continued forwards and ending below middle of eye. Posteriorly the lateral lines are connected by a transversal branch running over the back of the caudal peduncle close to the caudal base. First dorsal less high than second one, the first spine about equal to snout. In males the first spine is prolonged into a filament. Last ray of second dorsal about equal to snout and eye, longer than median rays, but slightly shorter than first ray. Anal rays slightly increasing in length to the last, which equals snout and half eye. Ventrals about equal to distance between branchial openings and tip of snout, pectorals shorter. Caudal pointed, in males the two median rays are produced. Colour of preserved specimens reddish brown above, creamy white below. Upper part of head, back, and sides of body and tail with numerous rounded or elongate lighter patches, bordered by dark. Sides with a row of dark patches and numerous smaller dark spots. First dorsal black posteriorly, anteriorly freckled or more or less striped grey and black. Second dorsal freckled with dark, forming more or less distinct oblique bars, and a dark edge to the fin. Anal white with a black terminal longitudinal band, interrupted by the rays, which are white and hence form a light outer edge to the dark band. Upper part of caudal with transverse rows of rather larger dark spots, lower border of the fin with a narrow dark subterminal and a light terminal longitudinal band. Ventrals and upper part of pectorals freckled with dark spots, lower half of pectorals uniform. A dark blotch before base of pectoral and another in its axil. Length 164 mm.

Habitat: Pulu Weh!; Nias!; Singapore; Sumatra; Celebes (Menado); Batjan; Ambon. — Lake Tomsah (Suez Canal), Red

Sea, Zanzibar, Coast of Arabia, Persian Gulf, Coast of Burma, Andamans?, Philippines. In sea.

Note. A specimen in the Zoological Museum of Amsterdam received from the late Dr. Annandale as *longicaudatus* and collected by the "Golden Crown" on the Arracan Coast does not belong to that species but to *filamentosus*. The description given by Day of *longicaudatus* from the Andamans seems to me also referable to *filamentosus*, as the number of anal rays is given as 9.

5. **Callionymus schaapi** Blkr.

Callionymus Schaapii Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 455. — Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 94.
Callionymus schaapi Jordan & Richardson, Mem. Carnegie Mus. IV, N° 4, 1909, p. 202.
Callionymus spec. M. Weber, Siboga Exp. Fische 1913, p. 525.
Callionymus schaapi Fowler, Proc. U. S. Nat. Mus. XC, 1941, p. 16.

D^1. IV. D^2. 9 (10). A. 8-9 (10). P. 15-17. V. I. 5.

Height 7.9-9.5, 11.4-12.4 in length with caudal. Head measured from gillopenings to tip of snout 3.8-4.3, 5.1-6.8 in length with caudal. Length of head, measured as above, 1-1.1 in its breadth. Eye 3-3.2, less than or equal to snout. Interorbital space narrow, one fourth or less than one fourth of eye. Mouth horizontal, lower jaw included. Maxillary not quite reaching to below eye. A few rows of pointed teeth in the jaws. Preopercular process strong, curved, with a moderate straight spine anteriorly, ending posteriorly in a hook, and with about 4-5 thorn like spines at its inner side, the spines decreasing in length posteriorly. Area behind eyes covered by smooth skin, without distinct rugosities laterally or posteriorly. Branchial openings one eye diameter or somewhat more behind eye, their distance equal to that of the outer borders of the eyes. Lateral lines of both sides beginning near inner side of branchial openings, connected by a transverse branch and continued forwards, bifurcating behind eye, one branch running downwards and somewhat backwards on opercle, the other running forwards and ending below eye. Lateral lines connected again by a transverse band, running over the back of the caudal peduncle near base of caudal. First dorsal as deep as body, the first spine equals snout and eye together. In males the three anterior spines have a filamentous prolongation, as long as or much longer than head. First ray of second dorsal somewhat more than eye, last ray equal to distance between branchial opening and frontborder of eye. First anal ray about equal to snout, last ray as long as snout and eye. Ventrals as long as distance between tip of snout and end of preopercular process. Pectorals shorter. Caudal pointed, longer and more pointed in males. Colour of preserved specimens brownish above, light below. Upperside of head, back, and sides of body and tail with numerous dark spots of different size, and with light blotches or rounded ocelli. A distinct black blotch before base of pectorals. First and second dorsals with some small dark spots, but without black blotches. Anal white with a terminal dark band, formed by streaks on the membranes, the rays being white to their tips. Caudal dusky, more or less spotted with dark in its superior half. Pectorals with indistinct rows of dark spots, ventrals dusky, edged with blackish. Length 102 mm (Typical specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Singapore; Pulu Weh!; Banka; Java; Celebes (Makassar!); Sumbawa! — Formosa, Philippines. In sea.

6. **Callionymus annulatus** M. Weber.

Callionymus annulatus M. Weber, Siboga Exp. Fische 1913, p. 523.

D^1. IV. D^2. 9. A. 9. P. 19. V. I. 5.

Height 8.2-9.3, 12.5-13.2 in length with caudal. Head measured from gill openings to tip of snout 3.5-3.7, 4.6-5 in length with caudal. Breadth of head 1-1.1 in length measured as above. Eyes large, 2.5-2.6, contiguous, the interorbital space being a narrow bony bridge. Snout 1.2-1.3 in eye. Mouth horizontal, lower jaw included. Maxillary reaching to below frontborder of eye. A few rows of short pointed teeth in the jaws. Preopercular process strong, straight, not tapering posteriorly but ending in a hook. A strong pointed spine anteriorly and 4-6 strong thorn like spines along its inner side, these spines decreasing in size posteriorly. A smooth area behind eyes, surrounded laterally and posteriorly by a rugose area, covered with skin. Branchial openings less than one eye diameter behind eyes and one eye diameter apart. Lateral lines of both sides beginning near the inner side of the branchial openings, connected here by a transverse branch, and continued forwards to below eye. No distinct branch on opercle. No posterior connection between the lateral lines on caudal peduncle. Two anterior spines of first dorsal slightly produced in the female, as long as snout and eye. In the males the three anterior spines are produced and longer than head. First and last rays of second dorsal subequal, longer than the median ones, and equalling snout and half eye. Anal rays somewhat increasing in length posteriorly, the first slightly less, the last slightly more than eye. Ventrals equal to length of head measured as above, pectorals shorter. Caudal rounded, much longer in the males than in the females. Description made after the type, a male specimen of 76 mm length and the paratype, a female of 41 mm, the only specimens of this species known.

Habitat: Madura Strait, 56 M!; South Coast of Timor, 8-26 M!. On muddy bottom.

7. **Callionymus leucobranchialis** Fowler

Callionymus leucobranchialis Fowler, Proc. U. S. Nat. Mus. Vol. XC, N° 3106, 1941, p. 19.

D^1. IV. D^2. 9 (10) — 10 (11). A. 9 (10). P. 17-18. V. I. 5.

Depth $8^1/_2$-$10^3/_4$. Head $3^9/_{10}$-$4^3/_7$, as long as wide. Snout $2^3/_4$-3 in head. Eye $2^2/_3$-3, subequal with snout. Maxillary reaches seven-eighths to eye or little below front of eye. Outer ridge in males with row of denticles, entire in females. Mouth cleft horizontal, rictus three sevenths in space to eye. Lower jaw slightly included in male, jaws subequal or lower slightly protrudes in female. Teeth fine, minute, villiform, crowded and in narrow bands in both jaws. Interorbital space narrow bony frenum, with longitudinal groove, bony width about half diameter of pupil. Preopercular process long as eye, ends in short curved point behind, with three or four recurved spines along its inner edge, and a short spine basal in front directed forward. Lateral line complete, distinct, extends high along side of back out on caudal base, with or without loop over caudal peduncle above and just before caudal base. Parietal region smooth, radiating striae feeble and not very distinct. Dorsal spines all prolonged into slender free filaments terminally reaching well into caudal base in males, first dorsal spine $1^1/_2$ in head in females. First dorsal ray $1^1/_5$-$1^4/_5$. First anal ray $2^1/_{10}$-$2^2/_5$ in head. Caudal nearly as long as rest of fish in males, in females 3 in rest of fish. Pectoral as long as head in females, longer than head in males. Ventrals $1^1/_8$ in head. Colour in alcohol light brown on back, with many faint and indistinct brown rings, arcs, and mottlings. Under surface largely whitish. Groove of lower lip on each side of mandible dark brown. Throat, chest, and breast rather light to pale brown, with strongly contrasted white gills. First dorsal variegated with white marks on dark grey-brown background in males, less contrasted in females. Second dorsal pale or transparent whitish, with dull brownish spots on rays. Anal similar to second dorsal, or with oblique dark streaks below. Caudal pale or whitish basally, with five to seven transverse series of large rounded dark brown spots, in closed fin forming transverse bands, terminally fin darker or brown with still darker mottlings or obscure blotches. Pectoral pale, with about nine transverse brown lines. Ventral whitish basally and marked with many inconspicuous brown spots, in grey black terminally. Length 99 mm (After Fowler, not seen by me).

Habitat: Borneo (Sandakan Bay). — Philippines.

8. **Callionymus melanotopterus** Blkr.

Callionymus melanotopterus Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 31.
Callionymus fluviatilis Day, Fishes of India, Part II, 1876, p. 322.
Callionymus melanotopterus Bleeker, Versl. Akad. Amsterdam (2) XIV. 1879, p. 92.
?*Callionymus fluviatilis* Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXIX, 1937, p. 258.

D^1. IV. D^2. 9 (10). A. 9 (10). P. 18. V. I. 5.

Height 11, 14 in length with caudal. Head, measured from branchial opening to tip of snout, 3.9. Breadth of head between the preopercular spines about equal to its length as measured above. Eye 3.1, somewhat less than snout. Interorbital space very narrow, about one seventh of eye. Snout pointed, when seen from above. Lower jaw slightly included. Maxillary not reaching to below front-border of eye. Bands of villiform teeth in both jaws. Preopercular process curved, with one straight spine directed forward anteriorly and another spine, curved inwards, posteriorly. Three spines along the inner side of the process. Branchial openings about one eye diameter behind eye. Lateral lines of both sides beginning between branchial openings, connected by a transverse branch and continued forward as a sensory canal. These canals diverging widely and bifurcating at upper end of preopercle, one branch running forward to below eye, the other running backward and downward and ending on opercle. The lateral lines of both sides run to the base of the caudal and are again connected near their end by a branch, crossing the back of the caudal peduncle about midway between end of dorsal and base of caudal. First dorsal twice as high as body, the first spine which is close to the second almost as long as snout and eye together. Anterior and posterior dorsal rays somewhat longer than the median ones, slightly longer than longest spine of first dorsal. Posterior anal rays longer than anterior ones, equal to snout. Pectorals and ventrals subequal in length, about as long as snout and eye together. Caudal pointed. Colour of preserved specimen brown above, light below. First dorsal with a black, white edged ocellus. Length 92 mm. (A specimen of Bleeker's collection in the Amsterdam Museum seen by me).

Habitat: Singapore; Banka; Java (Jacarta); Borneo (Kapuas); Celebes (Makassar, Badjoa). — India (River Hooghly), Siam?, Annam, Philippines. In sea and in fresh water.

9. **Callionymus sagitta** Pallas

Callionymus sagitta Pallas, Specil. Zool. Fasc. VIII, 1770, p. 29.
Callionymus sagitta Bonnaterre, Tabl. Encycl. Ichth. 1788, p. 44.
Callionymus sagitta Lacepède, Hist. Nat. Poissons II, 1800, p. 327, p. 337.
Callionymus sagitta Cuvier & Valenciennes, Hist. Nat. Poissons XII, 1837, p. 301.
Callionymus sagitta Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 31.
Callionymus sagitta Günther, Cat. Brit. Mus. III, 1861, p. 146.
Callionymus sagitta Day, Fishes of India, Part II, 1876, p. 322.
Callionymus sagitta Bleeker, Versl. Akad. Amsterdam (2) XV, 1879, p. 90.
Callionymus sagitta Johnstone, Pearl Oyster Rep. II. Fishes 1904, p. 213.
Callionymus sagitta Jordan & Richardson, Bull. Bur. Fish. XXVII (1907) 1908, p. 283.
Callionymus sagitta M. Weber, Siboga Exp. Fische 1913, p. 523.
Callionymus sagitta Fowler & Bean, Proc. U.S. Nat. Mus. LXXI, Art. 10, 1927, p. 11.
Callionymus sagitta Herre, Notes Fish. Zool. Mus. Stanford Univ. 1934, p. 94.
Callionymus sagitta Blegvad, Fish. Iran. Gulf. Danish Sc. Inv. Iran, Part III, 1944, p. 175.

D^1. IV. D^2. 9 (10). A. 9 (10). P. 17-19. V. I. 5.

Height 8.1-9, 10-11.7 in length with caudal. Head measured from branchial opening to tip of snout 3.3-4, 4.2-5.7 in length with caudal. Breath of head between the preopercular processes equal to the length, measured as above. Eye 3.1-4.2, 1-1.5 in snout. Interorbital space very narrow, three eights to one fourth of eye. Snout pointed, when seen from above. Lower jaw slightly included. Maxillary not reaching to below frontborder of eye. Bands of villiform teeth in the jaws. Preopercular process curved with one straight feeble spine directed forward, anteriorly, and a spine curved inwards, posteriorly. Four or five spines along the inner side of the process. Branchial openings about one eye diameter and a half behind eyes. Lateral lines of both sides beginning between branchial openings, connected by a transverse branch, each continued forward as a sensory canal. These canals diverging widely and bifurcating at upper end of preopercle, one branch running forward to below eye, the other running backwards and downwards, and ending on opercle. The lateral lines of both sides run to the base of the caudal and are again connected near their end by a branch crossing the back of the caudal peduncle near the base of the caudal. First dorsal half as high as the body, the first spine which is close to the second, shorter than eye. Anterior and posterior rays of dorsal somewhat longer than the median ones and slightly less than eye and snout together. Anal rays increasing in length posteriorly, the last one equal to snout and half eye. Pectorals and ventrals subequal in length, slightly less than head. Caudal slightly rounded, the membranes between the rays incised. Colour of preserved specimens brownish above, freckled with darker and with larger and smaller milky white spots; uniformly light brownish below. A row of more or less dark brown blotches along sides of body and tail. First dorsal in females jet black, in males white at base, black distally. Second dorsal and caudal spotted with darker, anal uniform or with dark spots, especially in males. Ventrals and superior half of pectorals spotted, lower part of pectorals white. Length 112 mm.

Habitat: Singapore; Sumatra (Padang, Benkulen); Banka; Java (Jacarta); Borneo (Sampit, Sandakan); Celebes (Makassar!, Menado); Sumbawa!; Ambon. — Mauritius, Coasts of South Arabia, Iranian Gulf, Coasts of India, Ceylon, Tonkin, Philippines. In sea.

10. **Callionymus enneactis** Blkr.

Callionymus enneactis Bleeker, Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 95.
Callionymus enneactis Herre, Notes Fish. Zool. Mus. Stanf. Univ. 1934, p. 93.

D^1. IV. D^2. 8 (9). A. 7 (8). P. 1. 17. V. I. 5.

Height 9.5, 13 in length with caudal. Head measured from branchial opening 3.8, 5.2 in length with caudal. Eye 3.3, equal to snout. Interorbital space narrow, one sixth of eye. Maxillary reaching almost to below frontborder of eye. Teeth pointed, crowded. Upper part of head behind eyes smooth in the middle, flanked on both sides by a rounded rugose patch. Lateral lines of both sides connected by a transverse branch on occiput. No anterior branch on head and no connection over caudal peduncle.

Preopercular process short but strong, with an antrorse spine anteriorly, ending posteriorly in a somewhat hooked spine and with two more spines on its upper border. First dorsal high, the spines filamentous, the third as long as head measured as above, the second one half, the first one fourth of head longer. Rays of second dorsal increasing in length posteriorly, the last ray almost as long as head. Caudal pointed. The type of the species in the Leiden Museum, described above, has now lost its coloration excepting some dark streaks on the head, and a dark blotch on the first dorsal. Bleeker describes the colours as follows: Body above and sides olivaceous, variegated with brown, margaritaceous below. Sides of head spotted with brown, lower side of head with 4 aequidistant brown spots, placed in a quadrangle. Fins flavescens or pinkish hyaline. An oblong black ocellus, edged with margaritaceous, between the third and fourth dorsal spines of first dorsal, which has anteriorly 3 or 5 narrow brownish violaceous, oblique, undulating bands. Second dorsal, ventrals, and caudal with small brown spots. Superior and median part of pectorals variegated with brownish points. Ventrals bordered with brown. Length 55 mm. (Type of the species in the Leiden Museum examined).

Habitat: Singapore! — Philippines, Pelew Islands. In sea.

11. **Callionymus wilburni** Herre

Callionymus wilburni Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII, N° 12, 1935, p. 431.
?*Callionymus hudsoni* Fowler, Proc. U. S. Nat. Mus. XC. 1941, p. 8.

D. III. 8. A. 7-8.

Height 6.9-7. Head 3-3.1. Width of head 1.25-1.3 in its own length. Eye 3-3.25, equal to snout. Interorbital space narrow, much less than pupil. Preopercular process 3.2-3.25 in head. First dorsal low, 2.33 in head, or the first dorsal spine may be much elongated, thread-like, and then longer than the head. Least depth of caudal peduncle 4.66 in head. Pectorals 3.5-3.9, ventrals 3-3.33 in length. The wedge-shaped trunk is much flattened, the long tail subcylindrical. The mouth is small, the maxillary falling far short of the eye. The preopercular process has a sharp terminal tooth, two large hooked teeth on its inner margin, and an antrorse hook on its outer margin near its base. The small pointed snout is protractile and often much extended, but the measurements are made with it retracted. Colour in alcohol whitish or gray, covered by above with an intricate pattern of fine brown dots arranged in cross-bars and bands, the ground colour showing in pearly areoles and spots which form a complicated pattern of rounded spots and festoons. Posterior rays of first dorsal black or blackish. Anal colourless, or with dark margin. The other fins are all more or less cross-barred with brown or blackish spots. Length 22 mm. (After Herre, not seen by me).

Habitat: Waigeu. — Philippines? In sea.

12. **Callionymus kaianus** Gthr. (Fig. 12, p. 66)

Callionymus kaianus Günther, Rep. Challenger Exp. Zool. Part VI, 1880, p. 44.
Callionymus kaianus Alcock, Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 74.
Callionymus kaianus Tate Regan, Trans. Linn. Soc. London XII (3), 1908, p. 248.

D^1. IV. D^2. 9. A. 9. P. 21. V. I. 5.

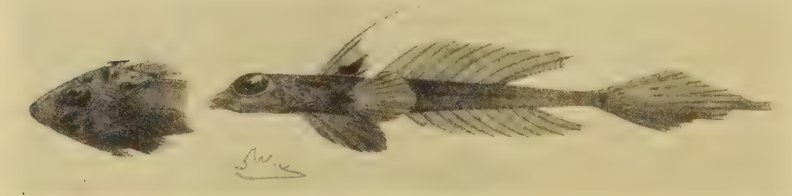

Fig. 12. *Callionymus kaianus* Gthr. After Günther.

Height 9-9.7, 13.4 in length with caudal. Head measured from branchial opening 4.2, 5.8 in length with caudal. Eye 4, about equal to snout. Interorbital space a very narrow bridge. Preopercular process shorter than eye, terminating in three hooks, of which the hindermost points backwards and the middle upwards, both being barbed; the third very small. The anterior dorsal spine is prolonged, especially in the male, in which sex it is not much shorter than the head. The rays of the second dorsal, in both sexes, are as long as the postorbital portion of the head. The ventrals are a little longer than the pectorals; in the female, but not in the male, they reach beyond the origin of the anal. The middle caudal rays are prolonged in both sexes, being between a third and a fourth the total length. Colour reddish, with irregular large rounded violet spots along the middle of the body; a lunate black spot, in both sexes, between the 3rd and 4th dorsal spines; second dorsal with a series of large subocellated bands, which are very conspicuous in the male. Length 175 mm. (Compiled, not seen by me).

Habitat: Madura Sea, 100 M; Kei Islands, 232 M. — Near Zanzibar, Saya de Malha Bank, 211 M, Malabar Coast, 184 M.

Note. A specimen long 150 mm in the collection of the Leiden Museum labelled "Java", *"Callionymus vittatus"*, apparently a museum name given by Schlegel, may possibly belong to this species. It differs in that the anterior spine on the upper side of the preopercular process, which is minute in *kaianus*, is well developed, and as long as the middle one. It is, however, not barbed as the other two. The eyes are slightly smaller and the interorbital space less narrow, being one fourth of the diameter of the eye.

13. **Callionymus tentaculatus** (Herre)

?*Amora tentaculata* Gray, Illustr. Indian Zoology, Hardwicke vol. 2, pl. 90. 1833-1834.
Callionymus spec. M. Weber, Siboga Exp. Fische 1913, p. 525.
Synchiropus tentaculatus Herre, Philip. Journ. Sc. XXXV, N° 1, 1928, p. 33.
Callionymus fimbriatus Herre, Notes Fishes Zool. Mus. Stanford Univ. 1934, p. 94.
Amora tentaculata Fowler, Proc. U. S. Nat. Mus. XC. 1941, p. 30.
Amora tentaculata Schultz & Woods, Journ. Washington Ac. Sci. XXXVIII, 1948, p. 420.

D^1. IV. D^2. 8. A. 7. P. 16. V. I. 5.

Height 5, 6.5 in length with caudal. Head measured from branchial openings to tip of snout 3.3, 4.5 in length with caudal. Breadth of head slightly less than its length, measured as above. Eye 2.4, equal to snout. A tentacle as long as pupil near the posterior margin of the upper part of the eye. Interorbital space one fifth of the diameter of the eye. Mouth horizontal, lower jaw somewhat included. Maxillary reaching to below frontborder of eye. Median part of postorbital region smooth with a rugose plate on each side, covered by skin. Preopercular process almost straight, bifid posteriorly and with a pointed spine at its base, directed anteriorly. Branchial openings about one eye diameter behind eye. Lateral lines of both sides connected by a transverse branch on nape, continued forward as a sensory canal bifurcating near hindborder of eye, one branch running forward to below eye, the other downwards and somewhat backwards on preopercle. First and second spines of first dorsal longer than the others, somewhat filamentous and equal to head without snout (male) or less high and about twice in head. Rays of second dorsal subequal, about as long as snout and eye. Anal rays slightly increasing in length posteriorly, the last equal to snout and half eye. Ventrals equal to distance between tip of snout and of preopercular process. Pectorals less than head. Caudal slightly rounded. Colour of a preserved male specimen pinkish, belly and throat whitish. Light brown ocelli edged with lighter, along base of first and second dorsals. Indistinct brown blotches along the sides. First dorsal with two longitudinal brown bands. Second dorsal without distinct markings, last ray dusky. Anal with oblique brown bars formed by spots on the rays. Ventrals with a brown transverse curved band near its base and near tip. Pectorals and caudal hyaline. In the female the first dorsal seems to be without marks and the ocelli along the back are not mentioned by Herre. Length 29 mm.

Habitat: Borneo (Sandakan); Sulu Islands; Celebes (Makassar!); Ambon? In sea.

2. **Diplogrammus** Gill

(Gill, Lyc. Nat. Hist. New York, 1865, p. 143, footnote)

Synchiropus Bleeker, Versl. Akad. Amsterdam (2) XIV (1877), 1879, p. 80, p. 100 (nec Gill).
Calymmichthys Jordan & Thompson, Mem. Carnegie Mus. VI, 1914, p. 296.
Dicallionymus Fowler, Proc. U. S. Nat. Mus. XC, 1941, p. 29.
Dermosteira L. P. Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 267.

Head and body slightly depressed. Preopercular process with an antrorse spine. Branchial openings situated high up, but still lateral, covered by a small opercular flap. Lateral line ascending with a gentle curve to origin of second dorsal and then descending in the same way to middle of caudal peduncle. First dorsal with IV spines. Second dorsal with 8 (9) rays. Last ray of ventrals connected by a membrane to the base of the pectoral. Caudal rounded or slightly pointed.

Distribution. Two species, one from the Indo-Australian archipelago and one from Rose Island, Samoa.

Note. Bleeker (1858) first described the species *Callionymus goramensis* as having two lateral lines, the second inferior one running from behind origin of anal to base of caudal. This induced Gill to create the genus *Diplogrammus*. Later Bleeker (1879) came to the conclusion, that this so called second lateral line is but a fold of the skin and he placed *goramensis* in the genus *Synchiropus*. It differs, however, from the species of lastnamed genus in having an antrorse spine on the preopercular process and in the lateral line, which is not straight, but with a gentle curve, the top of which is at a short distance below the origin of the second dorsal. I therefore retain the genus *Diplogrammus*.

1. **Diplogrammus goramensis** (Blkr) (Fig. 13, p. 69)

Callionymus goramensis Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 214.
Synchiropus goramensis Bleeker, Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 101.
Dicallionymus goramensis Fowler, Proc. U. S. Nat. Mus. XC, 1941, p. 29.

D^1. IV. D^2. 8 (9). A. 7 (8). P. 17. V. I. 5.

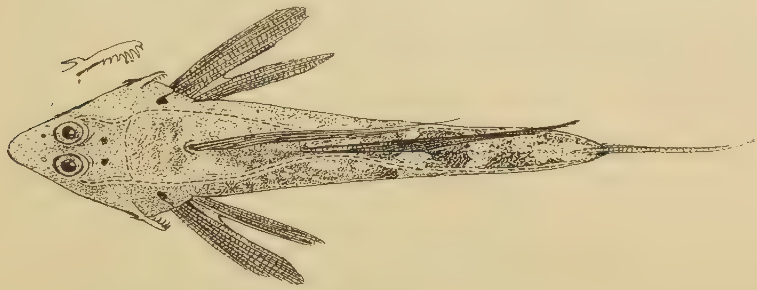

Fig. 13. *Diplogrammus goramensis* (Blkr.) × $^5/_3$.

Height 8.3, 11.3 in length with caudal. Head 4.5, 6.2 in length with caudal. Eye 3.3, 1.6 in snout. Interorbital space narrow, one fourth of eye. Maxillary almost reaching to below frontborder of eye. Preopercular process longer than eye, with a pointed antrorse spine, ending posteriorly in a hook, which is curved upwards. Six spines on upperside of process, the most posterior one longest, the two anterior ones very small. Lateral lines of both sides connected through a transverse branch over the nape. The lateral line is continued forwards to the hindborder of the eye where it curves downwards and ends, this last vertical part less than eye. There is no connecting branch of the lateral lines over caudal peduncle. First dorsal spine very long, reaching on middle of second dorsal when laid down; second shorter, third and fourth much shorter. Rays of second dorsal increasing in length posteriorly, the last equal to distance between tip of snout and end of preopercular process. First anal ray as long as snout and half eye, last anal ray equal to distance between base of preopercular process and tip of snout.

Pectorals as long as head. Ventrals equal to distance between tip of snout and base of second dorsal spine. Caudal somewhat pointed. The colour of the type, described here, has now faded but Bleeker describes it as follows: Pink above, pinkish white below. Back and sides with pinkish white irregular spots, margined with brown or violet. Snout and cheeks with narrow curved bands, sides and underparts with numerous bluish margaritaceous dots. Dorsal fins hyaline with numerous light blue spots; upper part of spinous dorsal slightly reticulated with violet, that of second dorsal with round blue dots and larger spots. Pectorals, ventrals, and anal light pinkish orange with numerous light blue smaller or larger spots, and with violet spots. Edge of anal with a terminal white and a subterminal brownish violet band. Caudal pinkish orange, with light blue oblong dots or small short stripes, the lower half of the fin with 5 or 6 transverse rows of brown spots. Length 68 mm. (Type of the species in the Leiden Museum examined).

Habitat: Goram!; Pandanan Island.

3. **Synchiropus** Gill

(Gill, Proc. Acad. Nat. Sc. Philadelphia (1859) 1860, p. 129)

Head and body cylindrical or slightly depressed, tail more compressed. Preopercular process without spine anteriorly. Branchial openings more or less lateral. Opercle without free cutaneous flap. First dorsal with IV spines. Second dorsal with 8-9 rays. Anal with 7-8 rays. Last ray of ventrals connected by a membrane to base of pectorals. Caudal truncate or slightly rounded.

Distribution. Tropical and subtropical parts of Indic and West Pacific.

Key to the Indo-Australian species of Synchiropus

1. P. 19 . . . . 1. *S. ocellatus* p. 71.
2. P. 23-24
    a. Height 5.3 . . . . 2. *S. delandi* p. 72.
    b. Height 3.66 . . . . 3. *S. zaspilus* p. 73.
3. P. 29-32
    a. Back with ocelli, sides with larger ocelli, partly kidney-shaped . . . . 4. *S. picturatus* p. 74.
    b. Body covered with sinuous bands, some of which intrude on second dorsal . . . . . . 5. *S. splendidus* p. 75.

1. **Synchiropus ocellatus** (Pallas) (Fig. 14, p. 72)

Callionymus ocellatus Pallas, Spicil. Zool. VIII, 1770, p. 26.
Callionymus punctulatus Lacepède, Hist. Nat. Poissons II, 1800, p. 340.
Callionymus ocellatus Bloch Schneider, Syst. Ichth. 1802, p. 40.
Callionymus ocellatus Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 422.
Synchiropus ocellatus Gill, Proc. Acad. Nat. Sc. Philadelphia (1859) 1860, p. 130.
Callionymus microps Günther, Fische der Südsee II, Part I, 1876, p. 192.
Callionymus ocellatus Bleeker, Versl. Akad. Amsterdam (2) XIV (1878) 1879, p. 98.
Synchiropus lili Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 415.
Synchiropus ocellatus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 282.
Callionymus ocellatus M. Weber, Siboga Exp. Fische 1913, p. 524.
Synchiropus ocellatus Herre, Notes Fishes Mus. Stanf. Univ. 1934, p. 94.

D^1. IV. D^2. 8 (9). A. 7 (8). P. 19. V. I. 5.

Cylindrical, tail somewhat compressed. Height 4.8-5.1, 6.4-6.8 in length with caudal. Head, measured from branchial opening, 3.2-3.3, 4.3-4.4 in length with caudal. Breadth of head 1.1-1.4 in its length, measured as above. Eye 3.3-3.4, equal to snout. Interorbital space narrow, concave, about one third of eye. Mouth small, transverse, horizontal. Maxillary not reaching below front border of eye. Jaws equal. A few rows of small pointed teeth in the jaws. Preopercular process without anterior spine, broad at base, tapering posteriorly and ending in a bifid spine which is somewhat curved upwards. No spines along the upper border of the process. Area behind eye covered by smooth skin. Branchial openings looking upwards, laterally covered by the upper border of the opercle, but visible from above. Lateral line beginning above branchial opening, not connected with that of the other side on head or on tail, not continued forward on head. Origin of first dorsal twice nearer to tip of snout than to base of caudal. First dorsal almost as high as second dorsal in females, the first ray equal to snout and half eye.

In males the dorsal is much higher and the spines, which are subequal, may be as long as the head, measured as above. Rays of second dorsal slightly increasing in length posteriorly, the last ray equal to head without snout. Anal rays also slightly increasing in length posteriorly, the last ray as long as last dorsal ray. Ventrals half length of snout shorter than head, pectorals longer than head. Caudal slightly rounded. Colour of preserved specimens reddish brown, creamy below. Nape, back, and sides with large creamy or pinkish blotches with irregular rounded borders, forming indistinct cross bands. First dorsal black in females, with a broad creamy edge. In adult males the first dorsal is pinkish, with reddish brown sinuated and often anastomosing longitudinal bands in its basal part. These bands narrowly edged with white. Superiorly the bands are broken into a row of four ocelli between the first to third spines, each ocellus reddish brown with a dark centre and edged with white. Second dorsal creamy with reddish brown blotches, sometimes forming oblique bands, and narrowly edged with white. Anal blackish or dark brown, the rays tipped with white. Caudal creamy with more or less irregular reddish brown transverse bands, edged with darker. Pectorals light creamy with dark spots arranged in transverse rows, and with small light blue spots (in males only?); these spots spreading on body between base of pectoral and head. Ventrals dark brown, edged with white and with a transverse white band in the middle, less distinct in adult specimens. Length 64 mm.

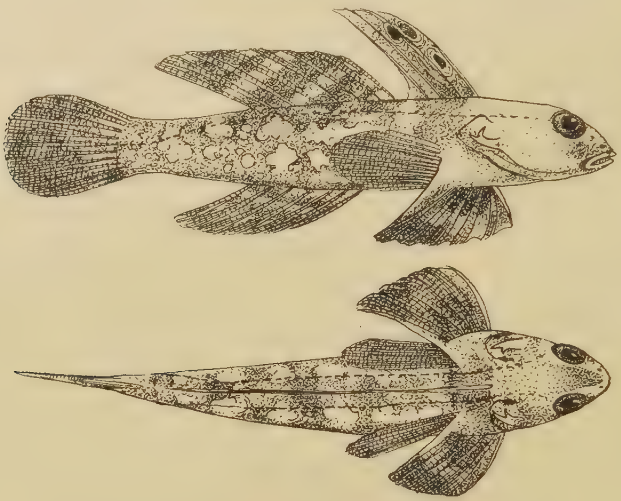

Fig. 14. *Synchiropus ocellatus* (Pallas). × 1½.

Habitat: Celebes (Menado, Tanawanko); Talaut Islands!; Kabaëna; Ternate; Ambon!; Goram; Nusa Laut!; Timor; Tiur! — Zanzibar, Riu Kiu Islands, Philippines, New Hebrides, Coast of North Queensland, Samoa, Tonga Islands. In sea.

2. **Synchiropus delandi** Fowler

Synchiropus delandi Fowler, Bull. U. S. Nat. Mus. 100. Vol. 14, part 2, 1943, p. 81.

D^1. IV. D^2. 8. A. 7 (8). P. 1. 22. V. I. 5.

Height 5.3. Head 3.25, wide as long. Snout $4^1/_8$ (in profile) to gill opening; eye 3.75, exceeds snout, greater than interorbital space; orbit 2.5 in head. Maxillary reaches below front of eye, length 3.6 in head to gill opening, entire. Mouth cleft reaches about $^7/_8$ in snout, lower jaw little shorter than upper; teeth in villiform bands in jaws, none on palate; bony interorbital space moderately narrow, width $1^7/_8$ in eye, low. Preopercular spine slightly less than eye, curved, ends in slender upcurved spine and rather large forward curved denticle on inner upper edge; no basal spinule in front. Lateral line complete, high at first, falls median along side of caudal peduncle. First dorsal spine $1^1/_{15}$ in head, first ray of second dorsal equal to length of head. First ray of anal $3^7/_8$, last ray $1^1/_8$. Least depth of caudal peduncle $4^1/_8$, pectoral $1^1/_{15}$, ventral $3^1/_6$ in fish without caudal. Caudal $1^4/_5$, lower rays longest. Colour in alcohol pale brown above, paler to whitish below. About 5 large gray brown blotches on back, mostly wider than paler interspaces and all more or less with rather large arcs or rings of darker. All along lower half of side of body parallel dark or grey bars. Head variegated with diffuse brown blotches above. First dorsal with five slightly darker brown blotches along first spine. Second dorsal pale, with two white longitudinal bands and upper anterior edge of fin narrowly black. Anal pale, with broad dark submarginal band. Caudal with five inclined, narrow, whitish bars along upper rays, hind edge of fin dark all around besides dark semitransverse basal band. Paired fins pale, dark blotch at upper base of pectoral. Length 189 mm. (After Fowler, not seen by me).

Habitat: Mabul Island, Sibuko Bay, Borneo, 468 M. — Point Tagolo Light, Mindanao, 315-360 M.

3. **Synchiropus zaspilus** (Herre)

Callionymus zaspilus Herre, Copeia 1933, N° 1, p. 24.

D^1. IV. D^2. 8. A. I. 7. P. 24.

Height 3.66. Head a trifle more than 3, the caudal 2.95, the ventral 3.44, the least depth of the caudal peduncle 5.5 times in the length. The breadth of the head is eight-ninths of its own length. The eye is 2.6, the small pointed snout 3, the interorbital space 3.75, the preopercular spine 2.77, the pectoral 1.5 times in the head. The first dorsal is low, the first spine 2.25 in the head; the second dorsal is of nearly uniform height, the sixth ray 1.8 times, the pectoral 1.5 times in the head; the eighth anal ray equals the ventral and is eight-ninths of the length of the head. The preopercular spine has two small, slightly curved spines on its upper margin and ends in a slender slightly curved point; the ventrals are longer than the pectorals but do not reach the anal. The ground colour of body and fins is grey; the dorsals, anal, pectorals, and ventrals, their bases and the adjacent parts of the body are marked by large conspicuous circular blue dots or bands formed by the fusion of such spots, each spot or band margined by a heavy white line, outside which is a broad indigo blue stripe, then another white stripe and lastly a thin blackish line; there is a similar large circular spot on the belly and several small spots of the same kind on the head, each with four borders also; the basal portion of the caudal has a broad blue transverse band, likewise margined on both sides by four stripes; the iris has a silvery-golden lustre, and from it radiate 6 or 7 black margined green stripes over the outer part of the eye, like spokes of a wheel; two are extended and cross the interorbital space, uniting with their fellows from the other eye; two others descend on the throat, but do not meet the others. Length 28 mm. (After Herre, not seen by me).

Habitat: Sulu Islands.

4. **Synchiropus picturatus** (Peters)

Callionymus picturatus Peters, Monatsber. Akad. Wiss. Berlin, 1876, p. 840.

D^1. IV. D^2. 9. A. 8. P. 30-32. V. I. 5.

Branchial opening very small, rounded, looking upward. A single lateral line. Head $3^1/_4$, caudal $3^3/_4$ in the total length. The flat preopercular process has two spines at its end and a third one on the middle of the upper border. The snout is pointed and the hindborder of the maxillary does not reach to below the frontborder of the eye. Teeth very small. The anterior part of the body is less compressed than usual in the species of the genus *Callionymus*. The lateral line runs superiorly, about between the first and second fourths of the heigth of the body. No scales. The well developed ventrals have a distinct spine and five articulated rays. The pectoral consists of very numerous short rays, the upper ones being very thin and thread-like. Colour pink, decorated with ocelli, which are black in the middle and encircled by three rings, an interior pink one, a median black one, and an exterior blue one. Pale stripes, bordered by black lines, radiate from the pupil. The ocelli of the back are smaller than those of the belly. Two ocelli on the nape, four pairs along the dorsals, and one on the tail. On the lower side a larger kidney-shaped ocellus runs from the inferor part of the preopercle. A second similar one is present at the base of each ventral, three especially large ones run downwards on each side to the anal, and the base of the caudal is encircled by a black cross band, bordered anteriorly by blue. The second fourth of the caudal is bluish, the end black. The first dorsal is decorated with an ocellus, the second dorsal and the anal are black with oblique blue lines. The pectorals and ventrals are light blue, the latter black at base. Length of the single specimen 21 mm (translated from Peters' description, not seen by me).

Habitat: Salawatti. In sea.

Note. Nothing more is known about this species than the record given by Peters. Bleeker ranged it among the species of *Callionymus,* without having seen it. It shows great resemblance to *S. splendidus* Herre in the great number of pectoral rays, and in the form of the preopercular spines and it may be only a young specimen of this species, which in that case has to be called *picturatus.* One doubtful point remains, viz. the position of the branchial openings. Peters only says that they are "nach oben gerichtet" and this would point to a condition as in *Callionymus* rather than in *Synchiropus.* However, the fact that they are directed upwards does not exclude the possibility that they are situated laterally and not on the upper part of the head. Re-examination of the type is necessary to settle its exact position.

5. **Synchiropus splendidus** (Herre)

Gallionymus [1]) *splendidus* Herre, Philip. Journ. Sc. XXXII, N° 3, 1927, p. 416.
Synchiropus splendidus Whitley, Rec. Austr. Mus. XVI, 1928, p. 222.
Synchiropus leopoldi Giltay, Mem. Mus. Roy. Hist. Nat. V, 1933, p. 83.

D^1. IV. D^2. 8-9. A. 7-8. P. 29-31. V. I. 5.

Height about 4. Head 3-3.25, its breadth four fifths of its own length. Eye 3.3, equal to snout and to somewhat concave interorbital space. Mouth small. Maxillary not extending to vertical of anterior margin of eye. Teeth minute, sharp, in bands in each jaw. Preopercular process without anterior spine ending in a short pointed spine and with 2-4 stronger spines along its upper border, the posterior of which is near the terminal spine and forms with it a bifid termination of the process. Branchial openings below and a

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1) Misprint for *Callionymus.*

little posterior to origin of lateral line. Lateral lines of both sides connected by a transverse branch on nape. First dorsal high, its height equal to snout and eye. First spine filamentous (males?) or not (females?). Second dorsal high, as high or somewhat higher than first dorsal, all rays branched. Anal similar to second dorsal, but shorter. Pectorals much shorter than head (attached to ventrals by a membrane?). Colour yellowish, body and tail darker yellowish or brown. Body covered with blue or green sinuous bands, bordered by black and variously arranged. One crosses nape, another crescentic one below first dorsal with a prolongation downwards to base of pectoral, sometimes developed into rows of spots. A longitudinal band along sides, above anal, connected or not with a transverse band on caudal peduncle. Two more bands on back of caudal peduncle before the one first mentioned, the former of these characteristically bent first forwards and then upwards, entering second dorsal and produced forwards as an oblique band on this fin to or near extremity of anterior rays. Below and above this band similar shorter bands on second dorsal, sometimes broken into rows of ocelli. Edge of this fin dark blue, with or without yellow markings. All these bands on body and tail irregularly developed, sometimes anastomosing, sometimes developed in rows of spots, one side of the same specimen may differ from the other side in this respect. Generally a large dark patch between pectorals and ventrals. Head with green or blue bands, radiating from eye. First dorsal dark (females?) or yellow or orange with longitudinal dark bordered bands or ocelli. Anal and caudal with dark streaks. Ventrals with dark edged ocelli or dark streaks. Pectorals light bluish, a dark blue basal band may be present. Length 64 mm (compiled, not seen by me).

Habitat: Sulu Islands; Banda; Philippines. — Coast of Queensland.

Note. None of the three authors who have described this species mention the presence of a membrane connecting last ray of ventrals with base of pectorals, but I assume that it is present as usual. If otherwise, the absence would certainly have been noted.

4. **Eleutherochir** Bleeker

(Bleeker, Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 80)

Head and body much depressed, tail somewhat compressed. Head flat above. Preopercular process rather strong, without spine anteriorly. Branchial openings reduced to small openings underneath the superior part of the opercles; excepting this opening the gill membranes are totally adnate to the skin of the shoulder girdle and of the isthmus, but the opercle has a large pointed free cutaneous flap. First dorsal consisting of IV short spines, its origin much nearer to point of snout than to base of caudal. Second dorsal with 9 (10) rays. Anal with 9 (10) rays, its origin behind first dorsal, its end about below that of second dorsal. Ventrals free, not connected by a membrane to base of pectorals.

Distribution: Indo-Australian Archipelago and Philippines.

1. **Eleutherochir opercularis** (C. V.) (Fig. 15, p. 78)

Callionymus opercularis Cuvier & Valenciennes, Hist. Nat. Poissons XII, 1837, p. 305.
Callionymus opercularoides Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 32.
Callionymus opercularis Günther, Cat. Brit. Mus. III, 1861, p. 151.
Callionymus opercularis Day, Fishes of India Part II, 1876, p. 323.
Eleutherochir opercularoides Bleeker, Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 103.
Callionymus opercularis M. Weber, Siboga Exp. Fische 1913, p. 522.
Callionymus kellersi Fowler & Bean, Proc. U. S. Nat. Mus. LXXI, Art. 10, 1927, p. 12.

D^1. IV. D^2. 9 (10). A. 9 (10). P. 21-24. V. I. 5.

Height 5.7-6, 7.2-7.5 in length with caudal. Head measured from branchial opening 2.9, 3.6-3.9 in length with caudal. Breadth of head 1.2 in its length, measured as above. Eye 3.9-4.4, 1.2-1.4 in snout. Interorbital space slightly concave, equal to or three fourths of eye. Mouth slightly oblique, lower jaw included. Maxillary reaching to below frontborder of eye. About 3 rows of small pointed teeth in the jaws. Preopercular process somewhat curved, without anterior spine, ending in a hooked spine which may be bifid, and with 3-6 strong spines along its upper border. Area behind eyes smooth in the middle; on both sides a rugose patch with low radiating ridges and covered by smooth skin. Lateral lines ramose in their anterior part, connected by a transverse branch at their origin, and continued forward, bifurcating into one branch directed downwards and running along the posterior border of the preopercle, and another running forwards, bending downwards behind eye, and ending below it. All these branches curved and more or less ramose. Posteriorly the lateral lines are continued on caudal, and are connected by a transverse branch over caudal peduncle. First dorsal low, the first spine equal to snout. Median rays of second dorsal longer than the anterior and the posterior ones, and equal to snout and eye. First anal ray equal to eye, rays increasing in length posteriorly, the last ray somewhat longer than snout. Pectorals equal to distance between tip of snout and base of preopercular process; ventrals slightly shorter. Caudal truncate. Colour brown or dark grey, nape and back with black dots. Indistinct dark stripes on cheeks. Throat and belly white. First dorsal black, rays of second dorsal with black spots, forming longitudinal rows. Anal rays and caudal rays dusky. Ventrals black. Pectorals dusky with darker spots in their superior half, more or less white inferiorly. Length 86 mm.

Habitat: Pulu Weh!; Sumatra (Padang, Trussan, Priaman, Benkulen); Java (Mouth of river Ompok!); Bali; Celebes (Makassar!, Gorontalo, Menado); Ternate!; Batjan; Ceram; Ambon!; Gébé; New Guinea (river Mbai!). — Philippines.

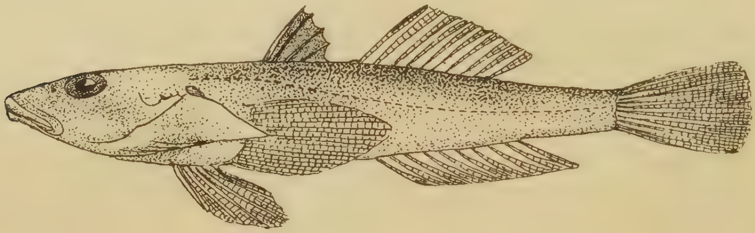


Fig. 15. *Eleutherochir opercularis* (C.V.) × $1^1/_3$.

In sea and brackish water.

5. **Brachycallionymus** Herre & Myers

(Herre & Myers, Proc. Biol. Soc. Washington XL, 1936, p. 12)

Body very short and heavy. Head large, very broad, somewhat depressed. The snout very short and broadly rounded when viewed from above; pointed when viewed from the side. Origin of first dorsal at middle of length without caudal. Eyes widely separated, at least one orbit diameter apart. Ventrals I. 5, far apart, the outer borders not attached to the skin in front of the pectoral. Gill opening small, latero-superior. Opercle prolonged backward beyond pectoral base in a long, narrow, blunt-tipped projection. Mouth wide, evenly curved, transverse, with little lateral gape, its width about equal to distance from pupil to pupil. Lower jaw very slightly inferior. Preopercle armed with a single long, straight, heavy spine, projecting far upward and outward, with 2 or 3 strong retrorse spines along its inner margin, the distal one almost at tip; length of each preopercular spine more than width of mouth. Lateral line conspicuous. First dorsal with III spines. (Herre & Myers).

Distribution that of the single species known.

1. **Brachycallionymus mirus** Herre.

Brachycallionymus mirus Herre, Proc. Biol. Soc. Washington XL, 1936, p. 12.

D. III. 9. A. 9.

Height 3-3.25. Head 1.6-1.7, breadth of head 2-2.1, caudal 3-3.2, pectoral 2.77-3.2, ventral 2.66-2.77 in length without caudal. Eye 4.5-5, snout 4.1-4.2, interorbital space 4.4-4.55, preopercular process 2.5-2.6, first dorsal 4-4.2, second dorsal 3.3-3.5, anal 3.3-3.75 in head. Snout broadly rounded. Mouth width 3.25 in head. The preopercular process projects upward and outward continuously with the curve of the snout, their tips far apart, the distance between tips 1.25 in length without caudal. The gill opening is an elongate, more or less vertical slit at the side of the nape, in the curve of the skin connecting opercular flap with head. Colour in alcohol pale brown with 5 or 6 broad, darker brown cross bands, the first two before the first dorsal, the third under the first dorsal, the others narrower and below the second dorsal. Ventrals velvety dusky brown above. Other fins colourless. Length 18 mm. (After Herre, not seen by me).

Habitat: North Coast of Celebes. — Philippines.

Note. Fowler (Proc. U. S. Nat. Mus. XC, 1941, p. 26) says: "There is hardly any question that the small specimens named as *Brachycallionymus mirus* Herre are the young of *Eleutherochir opercularis*". Schultz & Woods (Journ. Washington Ac. Sci. XXXVIII, 1948, p. 420) are of the same opinion.

6. **Dactylopus** Gill

(Gill, Proc. Acad. Nat. Sc. Philadelphia 1859, p. 130)

Vulsus Günther, Cat. Brit. Mus. III, 1861, p. 151.

Head and anterior part of body somewhat depressed, the rest subcylindrical. Preopercular process stout, conical, without antrorse spine and with few small spines along its upper border and larger ones along its lower border. Branchial opening short, lateral, not covered by opercular membrane. First dorsal consisting of IV spines, second dorsal of 8 (9) rays. Anal with 7 (8) rays. The ventral spine and the first ventral ray are detached from the rest of the fin and form together one rod-like organ, ending in a more or less swollen globular knob. The last ray of ventrals united by a membrane to the pectoral. Caudal rounded.

Distribution that of the single species known.

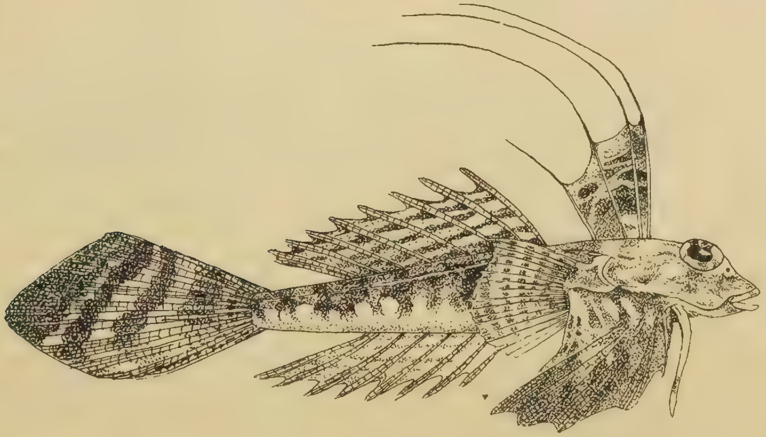
Note. Günther l.c. changed the name of this genus into *Vulsus,* as he was of opinion that *Dactylopus* was preoccupied by Dactylopoda, a name given by von Meyer to a group of reptiles (see Gill, Ann. Lyc. Nat. Hist. New York, 1865, p. 143, footnote). According to the present rules of nomenclature this is not a valid argument for the rejection of *Dactylopus* Gill. It is true that the name *Dactylopus* has been used by Claus for a genus of Crustacea, but *Dactylopus* Gill antedates that of Claus by three years.

Dactylopus dactylopus (C. V.) (Fig. 16, p. 81)

Callionymus dactylopus Cuvier & Valenciennes. Hist. Nat. Poissons XII, 1837, p. 310.
Callionymus dactylopus Bleeker, Nat. Tijdschr. Ned. Indië II, 1852, p. 559.
Dactylopus Bennetti Gill, Proc. Acad. Nat. Sc. Philadelphia 1859, p. 130.
Vulsus dactylopus Günther, Cat. Brit. Mus. III, 1861, p. 152.
Vulsus dactylopus Bleeker, Versl. Akad. Amsterdam (2) XIV (1877) 1879, p. 105.
Dactylopus dactylopus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 46.
Dactylopus dactylopus Ogilby, Proc. Royal Soc. Queensl. XXIII, 1910, p. 46.
Dactylopus dactylopus McCulloch, Biol. Results "Endeavour" III, 1915, p. 149.

D^1. IV. D^2. 8 (9). A. 7 (8). P. 19. V. I + 1. 4.

Height 5.3-5.6, 7.2-7.6 in length with caudal. Head 3.3-3.6, 4.5-4.9 in length with caudal. Eye 3.1-3.5, 1-1.3 in snout. Interorbital space narrow with a deep longitudinal furrow, 2.7-3.6 in eye. Mouth protractile, slightly oblique. Cardiform bands of teeth in the jaws. Preopercular process with two small spines on its upper border and four larger ones on its lower border. Membranes of first dorsal deeply incised, the spines produced into thread-like filaments in males, reaching to second half of soft dorsal when the fin is laid down. Second dorsal high, its height almost equalling length of head. First ray slightly less than the following, which are subequal, their membranes deeply incised. First anal ray equal to snout and half eye, the following rays increasing in length, the last as long as distance between tip of snout and origin of spinous dorsal. Last ventral ray longest, equal to distance between tip of snout and end of base of first dorsal. The first detached ray and spine of ventrals equal to distance between tip of snout and origin of first dorsal, and as long as pectorals. Caudal rounded. Lateral line unbranched. Colour of preserved specimens purplish above, creamy below. Back, sides, and upper parts of head with numerous lighter, black-edged ocelli of different size, the lower almost confluent with the light underside and larger, more or less arranged into a longitudinal row. First dorsal in males with a black, light-edged ocellus between the third and fourth spines, and a black blotch superiorly between the first and second. Rest of fin with undulating and bifurcating light longitudinal bands, narrowly edged with dark. In females these markings are less distinct. Second dorsal in males with longitudinal bands, each consisting of two narrow parallel stripes. In females this fin is clouded or marmorated with brown. Anal of males with longitudinal short stripes or rows of spots, in the females with a single row of larger dark spots. Superior half of caudal light with broad transverse dark bands, inferior half with longitudinal rows of short dark stripes. In the females the whole fin is transversely banded. Ventrals sprinkled with dark spots. Superior half of pectorals with transverse rows of spots, inferior half hyaline. Length 140 mm. (Specimens of Bleeker's collection examined).



16. *Dactylopus dactylopus* (C.V.) × $^2/_3$.

Habitat: Singapore; Celebes (Makassar, Amurang); Rotti; Buru; Ceram; Ambon; Nusa Laut; Kei Islands. — Philippines, Western Australia, Queensland. In sea.

2. Suborder **Kurtoidea**

Oblong, much compressed, covered with very small cycloid scales. Head naked, with exception of preopercle and opercle. Lateral line only developed for a short stretch behind head, otherwise wanting. Two nostrils on each side of snout. Subocular shelf absent, suborbitals feebly developed. Mouth large, protractile, terminal. Maxillary completely excluded from the border of the mouth. Opercular bones complete, but opercle, interopercle, and subopercle very thin and paper like. Preopercle with a few spines near its angle. Teeth present in villiform bands in jaws. Smaller teeth on head of vomer and on palatines. Males with a prominent hook on the occiput, formed by the supraoccipital and covered with skin. Anus immediately behind ventrals, far remote from tail. No anal papilla. One dorsal, with V-VII rudimentary spines in front, II well developed spines and 12-13 (14) rays. Anal with II spines and a rudimentary one in front, and with 31-47 rays. Caudal with 17 divided rays. Scapula and coracoid present. Pectorals with four hourglass shaped basalia, the lower one totally articulating with the coracoid, the next one partly with the coracoid, partly with the scapula. Ventrals with I spine and 5 rays, thoracic, the pelvic bone attached to the lower border of the cleithrum. Pelvics with a triangular bony projection, directed backwards, the left and right ones forming together a spine, hidden below the skin or not. 10 + 14 vertebrae. Second pair of ribs articulating without parapophyses with the vertebrae, the others with parapohyses, the 5th to 10th pairs of ribs coalesced with their parapophyses and with each other, much expanded, forming a bony case enclosing the upper part of the airbladder (*K. gulliveri*) or posteriorly also the lower part of this organ (*K. indicus*). Seven branchiostegals. Gillmembranes free from isthmus and from each other. Pseudobranchiae present.

Note. In a paper on the anantomy and the systematics of the genus *Kurtus* (Morph. Jahrb. XLVIII, Heft 3, 1914, p. 391) I expressed the view, that the Kurtoidea form an order of their own, related to the Berycoidea. This opinion was based on the assumption that an orbitosphenoid is present in *Kurtus*. I have now come to the conclusion, that what I thought was an orbitosphenoid is only the ossified interorbital membrane, and I agree with Tate Regan that the Kurtoidea can be given the rank of a suborder among the Percomorphi.

1. Family KURTIDAE

For characteristics of the single family see those of the suborder.

1. **Kurtus** Bloch

(Bloch, Ausländische Fische II, 1786, p. 121)
Cyrtus Cantor Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1127.

For the characteristics of the signle genus see above.

Key to the species of Kurtus

1. Anal with 31-32 rays . . . . 1. *K. indicus* p. 83.
2. Anal with 44-47 rays . . . . 2. *K. gulliveri* p. 84.

Kurtus indicus Bl.

Kurtus indicus Bloch, Ausländ. Fische II, 1786, p. 122.
Kurtus blochianus Lacepède, Hist. Nat. Poissons II, 1800, p. 516, p. 517.
Kurtus Blochii Cuvier & Valenciennes, Hist. Nat. Poissons IX, 1833, p. 44.
Kurtus cornutus Cuvier & Valenciennes, ibid. p. 426.
Cyrtus indicus Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1127.
Kurtus indicus Bleeker, Verh. Bat. Gen. XXIV, 1852. Bijdr. Makreelacht. visschen p. 78.
Kurtus indicus Günther, Cat. Brit. Mus. II, 1860, p. 510.
Cyrtus indicus Kner, Novara Exp. Fische I. 1865-1867, p. 172.
Kurtus indicus Day, Fishes of India, Part II, 1876, p. 174.
Kurtus indicus? Volz, Zool. Jahrb. Abt. Syst. XIX, 1903, p. 361.
Kurtus indicus Hardenberg, Treubia XV, 1936, p. 251.
Kurtus indicus Fowler, Hongkong Naturalist VII, 1936, p. 363.

D. V. + II. 12-13 (14). A. II. 31-32. P. 18. V. I. 5.

Heigth 2.3-2.7, 3.1-3.3 in length with caudal. Head 3.5-3.6, 4.3-4.8 in length with caudal. Eye 4.2-5.3, 1-1.7 in snout and 1-1.2 in convex interorbital space. Mouth very oblique. Maxillary reaching to below hindborder of eye. Lower jaw with a slightly prominent symphysial knob. Villiform teeth in both jaws, those anteriorly longer and more or less needle like. Minute conical teeth on head of vomer and on palatines. Preopercle with four spines near its angle, increasing in length posteriorly. Operculum very thin, paper like. Origin of dorsal slightly behind that of anal, the rudimentary spines not counted. Second developed dorsal spine about equal to snout and half eye; first ray equal to head without snout. Following rays decreasing in length posteriorly, the last one slightly more than snout. Second anal spine about as long as second dorsal spine. Median anal rays longest, about equal to postorbital part of head and half diameter of eye. A strong spine directed backward between the ventrals, which are equal to eye and snout. Pectorals as long as head. Caudal deeply forked, the lobes pointed. Colour of preserved specimens yellowish or brownish. A black blotch at occiput, in males at the base of the occipital hook. Upper part of head and vertical fins more or less powdered with black chromatophores. Length 126 mm.

Nomen indig. Ikan tjinta madu (Malay Jacarta); Ikan semar (Tegal); Ikan meru (Surabaya); Ikan semarum (Pasuruan).

Habitat: Singapore; Sumatra (Bagan Si Api Api!, Palembang); Banka; Java (Jacarta, Cheribon, Tegal, Surabaya, Grissee, Pasuruan); Madura; Borneo (Pamangkat, Sinkawang, Balikpapan!, Kapuas River). — India, Malay Peninsula!, China.

In rivers and estuaries, locally very abundant and occurring in large shoals.

2. **Kurtus gulliveri** de Casteln. (Fig. 17, p. 85)

Kurtus gulliveri de Castelnau, Proc. Linn. Soc. New S. Wales II, 1878, p. 233.
Cyrtus gulliveri Ramsay & Ogilby, ibid. (2) I, 1886, p. 10.
Kurtus Gulliveri M. Weber, Nova Guinea IX, Livr. 4, 1913, p. 591.

D. VII + II. 12 (13). A. II. 44-47. P. 17-19. V. I. 5.

Height 2.2-2.6, 2.9-3.3 in length with caudal. Head 3.2-3.3, 4-4.4 in length with caudal. Eye 6-6.4, 1.4 in snout and 1.5 in convex interorbital space. Mouth very oblique. Maxillary reaching to below hindborder of eye in young specimens, far beyond it in adult specimens. Lower jaw prominent, with a symphysial knob. Villiform teeth in both jaws, the inner ones longer and more slender. Small conical teeth in several rows on head of vomer, still smaller ones on palatines. Four spines at the angle of the preopercle, the posterior one much longer than the others. Opercle very thin, paper like. Origin of dorsal slightly behind that of anal, the rudimentary spines not counted. Second developed dorsal spine about half diameter of eye longer than snout and eye together. First dorsal ray equal to head without snout, the second and third rays slightly longer, the following regularly decreasing in length, the last about equal to snout and eye. First anal spine minute, second one slightly less than snout and eye. Anterior anal rays equal to snout and eye, slightly shorter than median rays and longer than posterior rays, the last ray being equal to snout. No visible spine between the ventrals. The last ray of the left and of the right ventral connected by a membrane to the median line of the belly just before the anus. Ventrals less than postorbital part of head. Pectorals about half length of snout shorter than head. Caudal deeply forked, the lobes pointed. Colour of preserved specimens yellowish brown, lighter below. Sides of head, body, and tail more or less silvery. Distal part of dorsal and caudal lobes dusky. Length 590 mm.

Habitat: New Guinea (Lorentz River and its tributaries!, Strickland River). — North Queensland (Norman River). In fresh and brackish water.

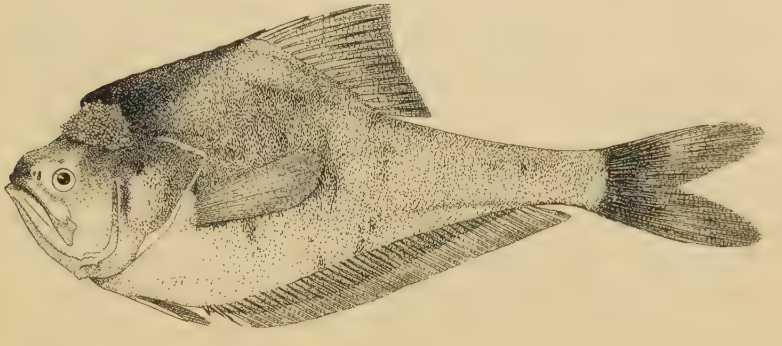


Fig. 17. *Kurtus gulliveri* de Casteln. After M. Weber.

Note. M. Weber (l.c. and Versl. Akad. Amsterdam XIII, 1910, p. 583) revealed the use which the male of this species makes of the occipital hook ,as in a few specimens collected by Lorentz it carried strings of eggs. The nature of this string had been studied by Guitel (Arch. Zool. exp. et genéral. LII, 1913, p. 1). It is not known how the female attaches these eggs to the hook.

3. Suborder **Stromatoidea**

Ovate or oblong, more or less compressed, covered with small or moderate, cycloid, generally deciduous scales. Head more or less scaly. Lateral line simple, complete. Two nostrils on each side of the snout. Second suborbital usually with an internal suborbital lamina. Mouth small or moderate, jaws generally weak, with a trenchant edge, having a single series of small, slender, pointed teeth. Palate and tongue rarely toothed. Oesophagus with lateral sacs, which are toothed internally. Dorsal fin long, with a distinct spinous portion, sometimes almost separate from the soft part of the fin, or the spinous portion consisting of rudimentary spines, more or less hidden below the skin. Anal generally with III spines, long. Pectorals generally broader in young, more pointed and relatively longer in adults, the upper rays growing at a greater rate than the lower ones. Pectoral pterygials regularly hourglass shaped, the first in contact with the coracoid. Ventrals, when present, with I spine and 5 rays, attached to the abdomen by a membrane, depressible in a more or less well marked groove or furrow. Pelvic bones attached, but not firmly united, to the pectoral arch. Origin of ventrals below or somewhat behind that of pectorals. Skeleton never strongly ossified. Opercular bones thin. A greater or lesser number of sessile ribs anteriorly, posterior ribs inserted on the transverse processes, where these unite to form a closed heamal arch. 24-26 vertebrae. Five to seven branchiostegals. Gillmembranes free from isthmus, except in *Pampus*. Pseudobranchiae present or absent.

1. Family Stromateidae

For characters of the single family see those of the suborder.

Key to the Indo-Australian genera of Stromateidae

I. Ventral fins present. Dorsal deeply notched, consisting of a spinous part and a soft part, almost separated into two fins. Gillmembranes free from isthmus.
  a. Body oblong, teeth on vomer and tongue . 1. *Cubiceps* p. 86.
  b. Body deeply ovoid. Palate edentulous . . 2. *Psenes* p. 87.
II. Ventrals absent. Dorsal consisting of soft rays with rudimentary spines in front, more or less hidden in the skin. Gillmembranes broadly united to the isthmus. Palate edentulous . . . 3. *Pampus* p. 91

1. **Cubiceps** Lowe

(Lowe, Proc. Zool. Soc. London 1843, p. 82)

Body oblong, moderately compressed, thorax much compressed and cultrate. Scales rather small, cycloid. Mouth small or moderate. Teeth in the jaws, on vomer, and on tongue. Palatines edentulous. Gillmembranes free from isthmus. Dorsal deeply notched, almost separate in two fins, the anterior one with X-XI spines, pointed, the second with I spine and 14-20 rays. Anal with III spines and 14-20 rays. Pectorals generally longer than head. Ventrals short, inserted posteriorly to the pectorals. Caudal deeply forked.

Distribution. Atlantic, Mediterranean, Red Sea, Indic, and Pacific.

1. **Cubiceps pauciradiatus** Gthr.

Cubiceps pauciradiatus Günther, Ann. Mag. Nat. Hist. (4) X, 1872, p. 423. — Brenchley's Cruise of the Curaçao, 1873, p. 420.
Cubiceps pauciradiatus Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 123.

D. XI. I. 17. A. III. 14. Ll. 48. Ltr. $\begin{matrix}2\frac{1}{2}\\ 1\\ 12\end{matrix}$.

Height 4.25. Head 3.5. Eye 3, equal to interorbital space. Snout shorter than eye. Maxillary extending to below anterior margin of eye. Jaws with a series of minute teeth, the vomer and the tongue are armed with a long elliptical patch of very small obtuse teeth. Anal beginning below seventh dorsal ray. Pectorals 1.3 times as long as the head, extending to the vent, more than twice as long as the ventrals. Caudal forked nearly to the base, the lobes can overlap each other. Purplish brown, fins lighter. Inside of the mouth and gill cavity black. Length of the single specimen known 120 mm. (After Günther and Tate Regan, not seen by me).

Habitat: Misol.

2. **Psenes** Cuvier & Valenciennes

(Cuvier & Valenciennes, Hist. Nat. Poissons IX, 1833, p. 259)

Body deeply ovoid, much compressed, covered with moderate or rather small cycloid scales. Mouth small, oblique, not protractile. A single series of distant teeth in both jaws. Palate edentulous. Gillopenings wide, gillmembranes only anteriorly attached to isthmus. Opercular bones feebly ossified. Dorsal deeply notched, almost separated in two fins, the first with X-XI feeble spines, the second with I spine and 15-34 rays. Anal with III spines and 15-34 rays. Pectorals broad, more or less pointed. Ventrals well developed, with I spine and 5 rays, their origin below that of pectorals. Caudal forked. Lateral line arched, following the dorsal profile.

Distribution. Atlantic, Indic, and Pacific. The young stages are pelagic, often in shoals. The adults probably live in deep water.

Key to the Indo-Australian species of Psenes

1. D. X. I. 21-24 (25). A. III. 23-27. Ll. 58-62.
Height 1. 9. . . . . 1. *P. cyanophrys* p. 88.
2. D. XI. I. 22. A. III. 22. Ll. 47. Height 1.1 . . 2. *P. arafurensis* p. 90.
3. D. XI. I. 19. A. III. 18. Ll. circa 55. Height 2.4 3. *P. whiteleggi* p. 90.

1. **Psenes cyanophrys** C. V. (Fig. 18, p. 89)

Psenes cyanophrys Cuvier & Valenciennes, Hist. Nat. Poissons IX, 1833, p. 260.
Psenes javanicus Cuvier & Valenciennes, ibid. p. 264.
Psenes auratus Cuvier & Valenciennes, l.c.
Psenes leucurus Cuvier & Valenciennes, ibid. p. 265.
Psenes Guamensis Cuvier & Valenciennes, ibid. p. 266.
Psenes javanicus Bleeker, Verh. Bat. Gen. XXIV, 1852. Bijdr. Makreelacht. visschen, p. 74. — Acta Soc. Sc. Indo-Neerl. II, 1857. Achtste bijdr. vischfauna Amboina, p. 60.
Psenes javanicus Günther, Cat. Brit. Mus. II, 1860, p. 494.
Psenes leucurus Günther, ibid. p. 495.
Psenes fuscus Guichenot, Mém. Soc. Sc. nat. Cherbourg (2) II, 1866, p. 138.
Cubiceps multiradiatus Günther, Proc. Zool. Soc. London 1871, p. 661.
Psenes javanicus Day, Fishes of India, Part II, 1876, p. 237. — Suppl. 1888, p. 790.
Psenes guamensis Günther, Fische der Südsee II, 1876, p. 145.
Psenes cyanophrys Günther, Zool. Challenger Exp. XXXI, pt. LXXVIII, 1889, p. 12.
Psenes javanicus Sauvage, Poissons de Madagascar, 1891, p. 334.
Psenes cyanophrys Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 125.
Psenes cyanophrys McCulloch, Checklist fish New S. Wales. Part II, 1919, p. 42.
Psenes cyanophrys M. Weber, Siboga Exp. Fische 1913, p. 152.
Psenes cyanophrys Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 893.
Psenes cyanophrys Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 138.

D. X. I. 21-24 (25). A. III. 23-27. P. 2. 16. V. I. 5. Ll. 58-62.

Ltr. $\begin{array}{c}9\\\hline 1\\\hline 23\text{-}25\end{array}$.

Height 1.9, 2.4-2.5 in length with caudal. Head 2.7-3.1, 3.4-4 in length with caudal. Eye with a narrow adipose eyelid, 3-3.5, somewhat more than snout and less than very convex interorbital space. Head scaly. Mouth very oblique. Maxillary not quite reaching to below frontborder of eye. Teeth pointed, somewhat curved, in single distant rows in both jaws. Dorsal spines weak, the first small, the median ones longest, equal to snout and eye. Tenth spine very small, eleventh spine close to rays, about equal to eye. First dorsal ray equal to snout and eye, following rays decreasing in length to the last which equals snout. Dorsal with a scaly sheath, forming a groove in which the spinous dorsal can disappear when laid down. Anal spines weak. Anterior anal rays longest, equalling snout and half eye, following rays decreasing in length, the last one less than snout. Origin of anal below origin of soft dorsal. Anal with a scaly sheath. Pectorals somewhat pointed, equal to head. Ventrals depressible into a groove of the belly, their length equal to postorbital part of head. Caudal forked. Colour of preserved specimens brown above. Sides of head, of body and of tail, and belly silvery. All scales with a brownish spot, forming narrow longitudinal bands. Spinous dorsal and ventrals blackish, soft dorsal and anal dusky. Caudal and pectorals yellowish. Length 125 mm.

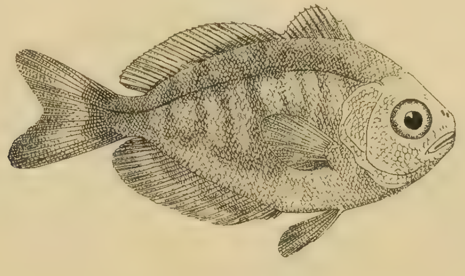


Fig. 18. *Psenes cyanophrys* C. V. × 1½.

Habitat: Java; Celebes (Menado); Makassar Strait; Celebes Sea; south of Sula Islands; between Makjan and Halmahera!; Lucipara Islands!; Kabia!; Binongka!; north of Flores; Ambon; north of Tenimber Islands; New Guinea. — Coast of Natal, Madagascar, Seas of India, Philippines, between Japan and New Guinea, coast of New South Wales, Guam.

In sea, pelagic when young, the adults probably living in great depths.

Note. Günther (1860, p. 495) records the habitat of a specimen as "(Gulf of Guinea?)". Bleeker (Verh. Holl. Mpij. Wetensch. (2) XVIII, 1863. Mémoire Poissons côte de Guinée) includes this species in his list of fishes known from the coast of Guinea, probably on the authority of Günther, although he mentions the species without query. As far as I know this is the only record of this species in the Atlantic, and I have therefore omitted it from the habitat.

M. Weber (l.c.) pointed out that *P. javanicus* of Day (l.c.) could not be this species as the lateral line is described as straight, but Barnard (l.c.) suggests that Day mistook the horizontal septum between the myotomes for the lateral line.

2. **Psenes arafurensis** Gthr.

Psenes arafurensis Günther, Zool. Challenger Exp. XXXI. Part LXXVIII, 1889, p. 13.
Psenes arafurensis Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 13.
Psenes arafurensis Norman, John Murray Exp. Sc. Rep. VII, N° 1. Fishes. 1939, p. 92.

D. XI. I. 22. A. III. 22. Ll. 47. Ltr. $\begin{matrix}9\\ \underline{1}\\ 20\end{matrix}$.

Height 1.7. Head 2.5. Eye 2.7, less than interorbital space. Snout 1.3 in eye. Lower margin of the preopercle crescent-shaped. Cheek entirely scaly. Spinous dorsal rather higher than soft dorsal. Pectoral broad, as long as head without snout and as the ventrals, which extend beyond the origin of the anal. Silvery, tail with some obscure cross-bands, which extend over, and are more distinct on, the anal fin. Ventrals black in their basal and terminal thirds. Length 39 mm. (After Günther and Regan, not seen by me).

Habitat: Arafura Sea. — Arabian Sea. Pelagic.

3. **Psenes whiteleggi** Waite

Psenes whiteleggii Waite, Proc. Linn. Soc. New S. Wales (2) IX, part 2, 1894, p. 218.
Psenes Whiteleggii Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 126.
Psenes Whiteleggii M. Weber, Siboga Exp. Fische, 1913, p. 153.
Psenes whiteleggii McCulloch, Checklist of Fish. New S. Wales, Part II, 1919, p. 42.
Psenes whiteleggii J. L. B. Smith, Rec. Alban. Mus. IV, 1935, p. 221.

D. XI. I. 19. A. III. 18. P. 18. V. I. 5. Ll. circa 55. Ltr. $\begin{matrix}4\\ \underline{1}\\ 18\end{matrix}$.

Height equal to head, 2.4, 3.4 in length with caudal. Eye 2.7. Snout about half diameter of eye. Convex interorbital space less than eye. Mouth oblique. Maxillary extending to below anterior border of eye. Teeth pointed, distant, in a single row in both jaws. Dorsal spines increasing in length to the third and fourth, which are equal to eye. Following spines decreasing in length, the eleventh one minute, the twelfth one longer again, close to the first dorsal ray, which is much longer and almost equals snout and eye. Following dorsal rays decreasing again in length to the last. Origin of anal below origin of soft dorsal, the spines weak, the first ray about equal to eye, the following somewhat decreasing in length to the last. Pectorals equal to head without snout. Ventrals equal to snout and eye. Caudal deeply forked. Colour of preserved juvenile specimens brownish, somewhat silvery below. Fins yellowish, first dorsal and ventrals somewhat dusky. In older specimens the body is crossed by 3 brownish transverse more or less distinct bands, the first very broad, extending from behind the head to the end of the spinous dorsal and downwards to the vent, the second one connecting soft dorsal and anal, the third at base of caudal. Length 47 mm.

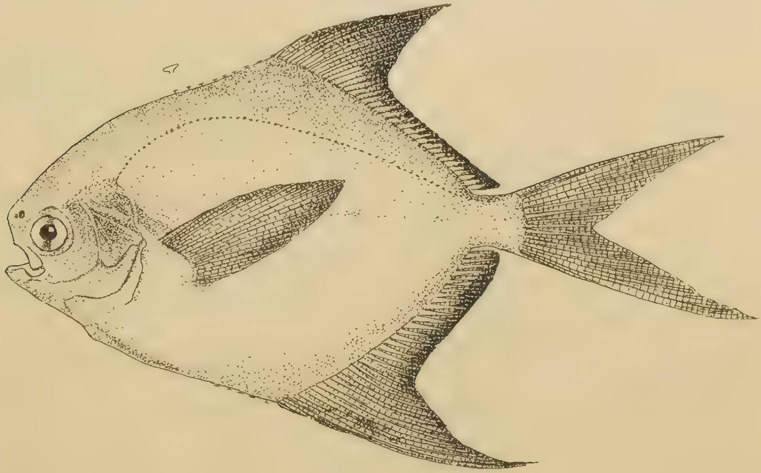


Fig. 19. *Pampus argenteus* (Euphr.) × $^4/_7$, and one of the dorsal spines enlarged.

Habitat: Kabaëna!; Ternate? — South-east Coast of Africa, New South Wales. In sea, pelagic.

3. **Pampus** Bonaparte

(Bonaparte, Iconogr. fauna italica III, Pesci, 1837, fasc. 9).
Stromateoïdes Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 368.
Chondroplites Gill, Proc. Acad. Nat. Sc. Philadelphia, 1862, p. 126.

Body deeply ovoid, much compressed, covered with very small deciduous cycloid scales. Mouth small, oblique, not protractile. A single series of crowded pointed teeth in both jaws. No teeth on palate. Gillrakers minute. Oesophagus laterally delated, the inner walls of these lateral sacs coated with papillae, which are provided with numerous small spines. Gillmembranes broadly united to the isthmus, the gillopenings restricted to vertical splits. Dorsal and anal with a number of small spines in front, ending in a transverse lamella and hence in the form of a T. They are more or less covered by skin in the adults. Soft dorsal and anal much elevated, covered with minute scales. Pectorals pointed. Ventrals absent. Caudal emarginate or forked. Lateral line arched, following the dorsal profile.

Distribution. Asiatic Coasts of Indic and Pacific and Coasts of Greater Sunda Islands, not known to occur beyond the continental shelf. In sea, brackish, and fresh water. Much esteemed as food fishes.

Key to the Indo-Australian species of Pampus

1. Anterior part of dorsal and anal developed into a deep lobe, posterior part low, consisting of rays of equal length. Caudal deeply forked . . . . . 1. *P. argenteus* p. 92.
2. Anterior part of dorsal and anal developed into a deep lobe, posterior part gradually decreasing in depth to the last. Caudal emarginate or feebly forked 2. *P. chinensis* p. 94.

1. **Pampus argenteus** (Euphr.) (Fig. 19, p. 91)

Stromateus argenteus Euphrasen, Kongl. Vetensk. Acad. Nya Handl. Stockholm IX, 1788, p. 49.
Stromateus cinereus Bloch, Ausländ. Fische XII, 1793, p. 90.
Stromateus argenteus Bloch. ibid. p. 92.
Stromateus candidus Cuvier & Valenciennes, Hist. Nat. Poissons IX, 1833, p. 391.
Stromateus argenteus Cuvier & Valenciennes, ibid. p. 393.
Stromateus securifer Cuvier & Valenciennes, ibid. p. 394.
Stromateus griseus Cuvier & Valenciennes, ibid. p. 395.
Stromateus punctatissimus Schlegel, Fauna Japonica, Pisces, 1850, p. 121.
Stromateus argenteus Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1124.
Stromateus cinereus Cantor, ibid. p. 1125.
Stromateoïdes cinereus Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 368. — Verh. Bat. Gen. XXIV, 1852. Bijdr. Makreelacht. visschen p. 75.
Stromateoïdes aculeatus Bleeker, Verh. Bat. Gen. XXV, 1853. Nalez. Ichth. Japan, p. 37.
Stromateus cinereus Kner, Novara Exp. Zool. Theil I, Fische, 1865-1867, p. 148.
Stromateus cinereus Day, Fishes of India, Part II, 1876, p. 247.
Stromateoïdes cinereus Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 206.
Stromateus argenteus Volz, Zool. Jahrb. Abth. Syst. XIX, Heft 4, 1903, p. 360.
Pampus cinereus Fowler, Proc. Acad. Nat. Sc. Philadelphia (2) LVII, 1905, p. 499.

Stromateoïdes cinereus Jordan & Starks, Proc. U. S. Nat. Mus. XXXI, 1906, p. 516.

Stromateoïdes argenteus Jordan & Seale, Proc. Davenport Acad. Sc. X, (1905) 1907, p. 8.

Stromateus cinereus Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 593.

Pampus lighti Evermann & Shaw, Proc. Californ. Acad. Sc. XVI, N° 4, 4th series, 1927, p. 114.

Pampus cinereus Fowler, Journ. Bombay Nat. Hist. Soc. XXXIII, N° 1& 2, 1929, p. 109.

Stromateus cinereus Wu, Contr. Biol. Lab. Sc. Soc. China V, Part I, 1929, p. 87.

Stromateoïdes cinereus Machan, Ann. Naturh. Mus. Wien XLIV, 1930, p. 438.

Stromateoïdes argenteus Fowler, Hongkong Naturalist II, 1931, p. 293.

Pampus cinereus Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 150.

?*Pampus simoprosopus* Fowler, l.c.

Pampus lighti Herre, Hongkong Naturalist VI, 1935, p. 291.

Pampus argenteus Fowler, ibid. VII, 1936, p. 194. — Ibid. Suppl. 6, 1938, p. 19.

Stromateus cinereus Blegvad, Fishes Iranian Gulf. Danish Sc. Inv. Iran, Part III, 1944, p. 178.

D. I. 37-42 1). A. I. 35-38 1). P. 23-26.

Height 1.3-1.5, 1.8-2.1 in length with caudal. Head 3.5-3.7, 4.8-5 in length with caudal. Eye with a feebly developed adipose eyelid, 2.9-3.8, 1.1-1.6 in very convex interorbital space. The snout is about two thirds of eye in young ones, almost equal to eye in adults. Mouth small, oblique, slightly inferior in adults, more so in young ones. Maxillary reaching to below frontborder of pupil in young, to below frontborder of eye in adults. A narrow row of villiform teeth in the jaws. The rays of the last seven tenth of the dorsal are low, being slightly less than eye, the rays of the anterior three tenths of the fin form a long falcate lobe, the median rays of this part longest and about equal to distance between tip of snout and base of pectoral. In young the transition from the lobe to the posterior part of the fin is less abrupt and the upper border of the fin therefore somewhat less concave. Origin of anal behind that of dorsal, similar in shape to that fin, but the lobes generally longer. Pectorals very long and pointed, slightly less than distance between symphysis of lower jaw and anus. In young ones these fins are comparatively shorter. Caudal very deeply forked, the lobes long and pointed. Colour of preserved specimens more or less brown above, silvery or white below. Fins yellowish. Lobes of dorsal and anal sometimes dusky. Length 300 mm.

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1) The hidden spines not counted.

Habitat: Singapore; Sumatra (Benkulen, Padang, Priaman, Bagan Si Api-Api, Tandjungpura, Baju Asin, Deli); Bintang; Banka; Java (Jacarta!, Cheribon!, Japara, Surabaja!); Borneo (Pamangkat, Sinkawang, Sarawak, Sandakan). — Coasts of India, Siam, Cochinchina, Malay Peninsula, Indochina, China, Korea, Japan, Riu Kiu Islands, Philippines. Introduced in Hawaii. In sea, brackish, and fresh water.

2. **Pampus chinensis** (Euphr.)

Stromateus chinensis Euphrasen, kongl. Vetensk. Acad. Nya Handl. Stockholm IX, 1788, p. 53.
Stromateus albus Cuvier & Valenciennes, Hist. Nat. Poissons IX, 1833, p. 388.
Stromateus atous Cuvier & Valenciennes, ibid. p. 389.
Stromateus candidus Bleeker, Verh. Bat. Gen. XXII (1848) 1849. Bijdr. ichth. fauna Madura, p. 4 (nec C. V.).
Stromateus sinensis Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1122.
Stromateoïdes atokoia Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 369. — Verh. Bat. Gen. XXIV, 1852. Makreelacht. visschen, p. 76.
Stromateoïdes atous Bleeker, Acta Soc. Sc. Indo-Neerl. VIII, 1860. Achtste bijdr. vischfauna Sumatra, p. 27.
Stromateus atous Kner, Novara Exp. Zool. Theil I. Fische, 1865-1867, p. 148.
Stromateus sinensis Day, Fishes of India, Part II, 1876, p. 246.
Stromateus sinensis Vinciguerra, Ann. Mus. Civ. Genova (2) IX, 1890, p. 171.
Stromateoïdes sinensis Tate Regan, Ann. Mag. Nat. Hist. (7) X, 1902, p. 205.
Stromateus sinensis Wu, Contr. Biol. Lab. Sc. Soc. China V, N° 4, 1929, p. 88.
Stromateoïdes sinensis Giltay, Mém. Mus. Royal Hist. Nat. V, 1933, p. 104.
Pampus sinensis Fowler, Hongkong Naturalist VII, 1936, p. 193.

D. 40 (41) 1). A. 40-43. P. 23.

Height 1.1-1.3, 1.4-1.6 in length with caudal. Head 3.5-3.7, 4.4-4.9 in length with caudal. Eye with a narrow adipose eyelid, 3.6-3.8, equal to snout and 1.4-1.8 in the very convex interorbital space. Mouth small, oblique, slightly inferior. Maxillary reaching to below frontborder of eye. A row of slender, truncate teeth in the jaws, those of the upper jaw smaller than those of the lower. Dorsal rays rapidly decreasing in length to the tenth, more gently increasing in length to about the sixteenth, which equals the distance between snout and base of pectoral or nearly so. The following rays decreasing again in length, at first rather abruptly, then more gently, the last ray equalling eye. Hence the upperborder of the dorsal is somewhat concave. Anal similar to dorsal, its origin behind that of dorsal. Pectorals pointed, equal to distance

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1) The hidden spines not counted.

between snout and base of pectoral; in young ones the pectorals are less pointed and shorter. Caudal emarginate in young ones, slightly forked in adults. Colour of preserved specimens brownish above, silvery or white below. Fins yellowish, dorsal, anal, and caudal dusky in their distal part in young ones. Length 210 mm.

Nomen indig. Bawal (Malay); Pèda (Balikpapan).

Habitat: Singapore; Sumatra (North of Medan, Bagan Si Api-Api, Padang); Banka; Java (Jacarta!, Cheribon!); Madura; Borneo (Kota Baru!, Balikpapan!, Sinkawang). — Coasts of India, Ceylon, Burma, Siam, Indochina, Malay peninsula, China.

4. Suborder **Siganoidea**

Oblong, compressed, covered with minute longitudinally elongate, thin cycloid scales. Sides of head more or less scaly. Lateral line simple, complete. Two nostrils on each side of the snout. No suborbital shelf. Mouth small, terminal, not protractile. Premaxillaries without peduncle. Jaws with a row of slender, compressed, rather small incisor-like teeth, which are bicuspid, irregularly tricuspid or slightly serrated. Palate and tongue without teeth. Dorsal with XIII strongly heteracanth spines, which are more or less antero-posteriorly flattened, and 10 soft branched rays. A sharp spine projects forward from the first interneural at the base of the first dorsal spine and pierces the skin of the nape. Anal with VII spines and 9 branched rays, the soft part of the fin equal in extent to that of the dorsal. Pectorals rounded, of moderate size. Ventrals with II spines, a proximal one, attached by a membrane to the skin of the belly, and a distal one. Three branched rays between them. Origin of ventrals behind that of pectorals. Caudal truncate, emarginate or deeply forked. 23 vertebrae. Pseudobranchiae well developed.

1. Family SIGANIDAE

For characters of the only Family see those of the Suborder.

1. **Siganus** Forskål

(Forskål, Descr. Animalium, 1775, p. 25)

Teuthis Linné, Syst. Naturae Ed. 12, 1766, p. 507 (pro parte).

Centrogaster Houttuyn, Verh. Holl. Maatsch. Wetensch. XX, Stuk 2, 1782, p. 333 [1]).
Amphacanthus Bloch, Schneider, Syst. Ichth. 1801, p. 206.

For characters of the only genus see above.

Key to the Indo-Australian genera of Siganus

I. Dorsal and ventral profile of head much concave, the snout forming a tube (*Lo*). (Fig. 20, p. 99) . . . . 1. *S. vulpinus* p. 98.

II. Dorsal and ventral profile of head concave. Snout slightly tubiform. (Fig. 21, p. 101).
   A. Spotted with dark . . . . 2. *S. corallinus* p. 100.
   B. With dark double transverse bands . 3. *S. tetrazona* p. 101.

III. Dorsal and ventral profile of head not markedly concave.
   a. Last dorsal spine about equal to or shorter than first one. Soft dorsal and anal low, rounded. Height 2.4-2.8. . .
      *a*¹. 18-19 rows of scales between ll. and median dorsal spines. Anterior nostril with a posterior flap. Caudal deeply forked. Brown, with darker spots scattered on sides . . . . . 4. *S. rostratus* p. 102.
      *b*¹. 17-18 rows of scales between ll. and median dorsal spines. Anterior nostril with a posterior flap. Caudal slightly emarginate, almost truncate. Dark with more or less distinct light vermiculating lines . . . . 5 *S. spinus* p. 104.
      *c*¹. 20-23 rows of scales between ll. and median dorsal spines. Anterior nostril with a low rim, slightly produced into a very short flap posteriorly. Caudal truncate in young, forked in adults. Brown, spotted with white . . . . 6. *S. oramin* p. 107.
      *d*¹. 25-30 rows of scales between ll. and median dorsal spines. Anterior nostril without flap. Caudal emarginate or slightly forked. Brown, sometimes with dark spots scattered on sides . . . . 7. *S. fuscescens* p. 110.
   b. Last dorsal spine much longer than first one. Height 1.8-2.4. Soft dorsal and anal high, more or less pointed or angular.

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1) Misspelled *Cantrogaster* on p. 332.

a^1. 30-35 rows of scales between ll. and median dorsal spines. Back and sides with light spots, more or less confluent into longitudinal bands. Caudal emarginate, truncate in young . 8. *S. javus* p. 111.

b^1. 18-24 rows of scales between ll. and median dorsal spines.

  a^2. Crossbars on snout, interorbital space and occiput.

    a^3. A broad dark band from chin through eye to origin of dorsal. A second one from below spinous dorsal to base of pectorals. These bands often indistinct in preserved specimens. Back with dark spots. Height 1.9-2 . . . . . 9. *S. virgatus* p. 113.

    b^3. No broad dark bands on head and body. Back with vertical lines. Height 2.1 . . . . . . 10. *S. doliatus* p. 114.

    c^3. No broad dark bands on head and body. Back and sides spotted. Height more than 2.5 . . . . 11. *S. canaliculatus* p. 115.

  b^2. Upper parts of head without crossbars.

    a^3. A broad dark band from chin through eye to origin of dorsal, spotted above eye with still darker. Body with undulating lines, vertical behind head, horizontal posteriorly 12. *S. puellus* p. 116.

    b^3. No broad dark band from chin to origin of dorsal.

      a^4. Caudal deeply forked, at least in adults.

        a^5. Uniform dark brown, each scale with a light spot in life . . 13. *S. punctatissimus* p. 117.

        b^5. Head and body with numerous spots, larger than interspaces, which form a network. A dark blotch at origin of lateral line . . . . 14. *S. chrysospilos* p. 118.

        c^5. Head and body with dark spots, which are larger than interspaces. A light blotch before dorsal . . . 15. *S. stellatus* p. 120.

b^4. Caudal emarginate or almost truncate in young and adults.
  a^5. Body covered with vermiculating lines. Caudal spotted . . . 16. *S. vermiculatus* p. 121.
  b^5. Body with spots, which are relatively larger in young and more or less confluent. Transverse oblique narrow bands on sides of head, one from corner of mouth to below eye always distinct in preserved specimens. A light blotch at end of dorsal may be present . 17. *S. guttatus* p. 123.

1. **Siganus vulpinus** (Schl. & Müller) (Fig. 20, p. 99)

Amphacanthus vulpinus Schlegel & Müller, Verh. nat. gesch. Ned. overzee. bez. Zool. 1839-1844, Beschr. Amphacanthus, p. 12.
Amphacanthus vulpinus Schlegel, Bijdr. Dierk. I, Afl. 5, 1852, p. 38.
Amphacanthus vulpinus Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 135.
Teuthis tubulosa Gray, Cat. Fish. Gronov. II, 1854, p. 142.
Teuthis vulpina Günther, Cat. Brit. Mus. III, 1861, p. 324. — Fische der Südsee I, 1873-1875, p. 91.
Lo vulpinus Seale, Occas. Papers B. P. Bishop Mus. IV, 1906, p. 71.
Lo vulpinus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 361.
Lo unimaculatus Evermann & Seale, ibid. XXVI (1906) 1907, p. 98.
Amphacanthus vulpinus M. Weber, Siboga Exp. Fische 1913, p. 330.
Siganus vulpinus Fowler & Bean, Proc. U. S. Nat. Mus. LXII, 1922, Art. 2, p. 59.
Siganus vulpinus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 285.
Lo unimaculatus Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 181.
Lo vulpinus Herre & Montalban, ibid. p. 182.
Siganus vulpinus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 332.
Lo vulpinus Herre, Notes Fish Zool. Mus. Stanf. Univ. 1934, p. 65. — Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 259.

D. XIII. 10. A. VII. 9. P. 2. 13-14. V. I. 3. I. Ll. about 140. Ltr. $\begin{array}{c}18\\\hline 1\\\hline 75\end{array}$.

Height 2-2.3, 2.5-2.8 in length with caudal. Head 3-3,2, 3.6-3.9 in length with caudal. Eye 4.5-5, 2.5-2.6 in the elongate, tubiform, compressed snout and 1.3-1.5 in almost flat interorbital space. Mouth small. Teeth long, pointed, with two more or less developed lateral cusps, in one series in the jaws. First dorsal spine somewhat more than eye, fourth longest, equal to or slightly longer than snout, following spines decreasing in length to the last. Soft dorsal pointed, median rays longest, equal to snout. First anal spine somewhat longer than first dorsal one, following spines subequal, last one somewhat less than snout. Pectorals rounded, equal to snout and eye. Ventrals half or three fourths diameters of eye shorter. Caudal slightly forked. Caudal peduncle slightly deeper than long, its greatest depth slightly more than eye. Colour of preserved specimens light brownish (orange in life). A broad dark brown band from origin of dorsal through eye to tip of snout, leaving a median band on upper part of head light or not. Rest of sides of head more or less whitish, with numerous brown dots, which may also extend on sides behind head. Chin light, thorax dark brown. Vertical fins yellowish. Two upper rays of pectorals dark brown. Anterior ventral spines dusky or brownish. Length 240 mm.

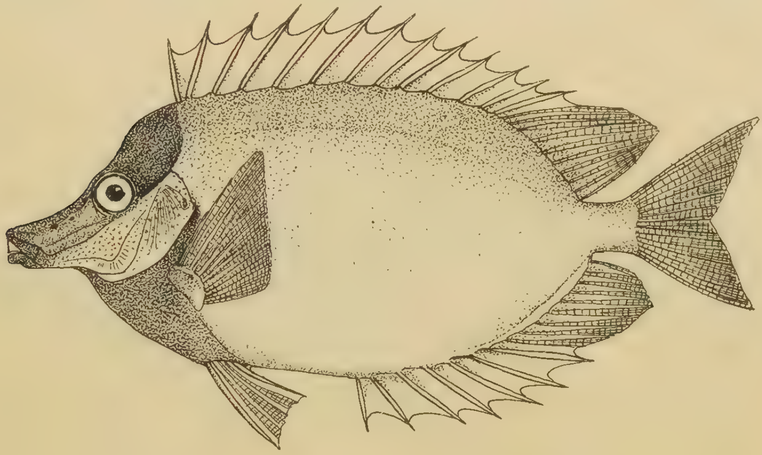

Fig. 20. *Siganus vulpinus* (Schl. & Müller) × 1/2.

Habitat: Java (Jacarta!); Birabirahan Island off Borneo; Sulu Islands; Celebes (Makassar, Menado, Kema, Limbe Strait); Togean Islands; Ternate; Tidore; Kajoa; Ambon; Ceram!; New Guinea (Manokwari). — Philippines, Pelew Islands, Carolines, Solomon Islands, Samoa. In sea.

Note. Seale l.c. has described specimens from the Philippines with a black lateral blotch below last dorsal spines as *unimaculatus*.

Fowler & Bean 1929. l.c. found this blotch very variable. In all specimens from the Indo-Australian Archipelago seen by me this blotch is wanting.

2. **Siganus corallinus** (C. V.). (Fig. 21, p. 101)

Amphacanthus corallinus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 139.
Amphacanthus corallinus Schlegel & Müller, Verh. nat. gesch. Ned. overz. Bezitt. Zool. 1839-1841, Beschr. Amphacanthus, p. 10.
Amphacanthus corallinus Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. Teuthieden, p. 11.
Teuthis corallinus Günther, Cat. Brit. Mus. III, 1861, p. 316. — Fische der Südsee I, 1873-1875, p. 88.
Teuthis corallina Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 287.
Siganus corallinus Jordan & Richardson, Bull. Bur. Fish. XXVI (1907) 1908, p. 271.
Siganus corallinus Fowler, Proc. Acad. Nat. Sc. Philadelphia LXX, 1918, p. 69.
Siganus corallinus Fowler & Bean, Proc. U. S. Nat. Mus. LXII, 1922, Art. 2, p. 58.
Teuthis corallina Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 159.
Siganus corallinus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 279.
Siganus corallinus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 301.
Teuthis corallina P. J. Schmidt, Trans. Pac. Comm. Acad. Sc. USSR. I, 1930, p. 105.

D. XIII. 10. A. VII. 9. P. 2. 14. V. I. 3. I. Ll. 160-175. Ltr. $\begin{array}{c}20\\\hline 1\\\hline 100\end{array}$.

Height 2-2.2, 2.6-2.9 in length with caudal. Head 3.3-3.6, 4.2-4.8 in length with caudal. Eye 3.3-3.8, 1.8-2 in snout and 1-1.3 in somewhat convex interorbital space. Upper and lower profile of head before eyes concave. First dorsal spine equal to eye, sixth or seventh spines longest, about as long as snout and half eye, last spine equal to snout or somewhat shorter. Soft dorsal pointed, median rays longest, equal to snout and half eye. First anal spine more than eye, third or fourth spines longest, equal to snout or somewhat longer. Soft anal similar to soft dorsal. Pectorals equal to snout and eye or somewhat longer, ventrals equal to snout and half eye. Caudal deeply forked, the lobes pointed. Caudal peduncle about as long as deep, its least depth equal to eye or four fifths of eye. Colour of preserved specimens yellowish or brown; head, thorax, and belly with small bluish dark edged ocelli, some of them fused into short stripes. Back and sides of body and tail either with similar spots or with black points, sides and posterior part of back sometimes without spots. Dorsal, anal, caudal, and pectorals brownish basally, yellowish distally. Ventrals yellowish but the first ray, which is visible when the fin is folded, brown with light spots. Length 277 mm.

Nomen indig. Bronang-bronang (Malay Jacarta).

Habitat: Sumatra (Padang); Batu Islands; Java (Jacarta!); Duizend Islands!; Lombok!; Celebes (Makassar!, Menado); Basa Islands; Dodepo and Pasejogo Islands; Limbe Strait; Tana Keke Islands; Sulu Islands; Halmahera; Ternate; Tidore; Gomomo Island; Buru; Ambon; Gisser!; Solor; New Guinea. — Seychelles, Siam, Riu Kiu Islands, Philippines, Pelew Islands.

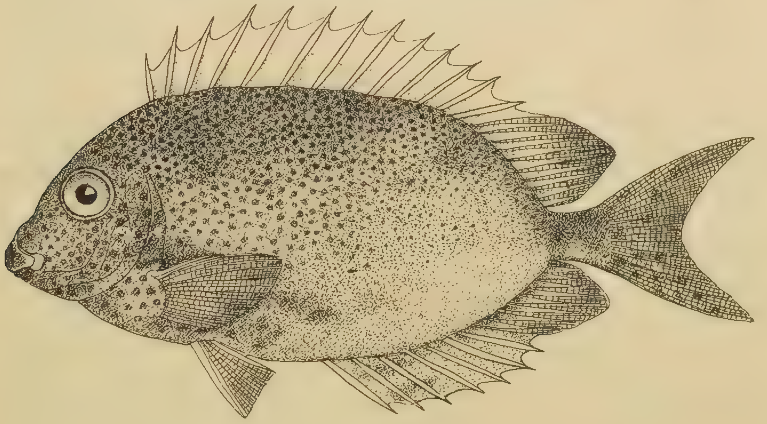

Fig. 21. *Siganus corallinus* (C. V.) × 1/2.

In sea, often on coral reefs.

3. **Siganus tetrazona** (Blkr)

Amphacanthus tetrazona Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 441.
Teuthis tetrazona Günther, Cat. Brit. Mus. III, 1861, p. 323.
Siganus tetrazonus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 35.
Siganus tetrazonus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 511.
Teuthis tetrazona Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 174.
Siganus tetrazonus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 324.
Teuthis tetrazona Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 64.

D. XIII. 10. A. VII. 9. P. 2. 14. V. I. 3. I.

Height about 3. Head almost 4. Profile of snout concave. Eye about 2.6. Ninth and tenth dorsal spines longest, about 2.4 in height of body. First spine shorter than the others. Soft dorsal slightly lower than spinous part. Last anal spine longest, scarcely higher than soft part of anal. Pectorals about 5.2 in length, ventrals about 7. Caudal slightly emarginate. Colour of body and fins yellow. Back with 4 transverse, double, undulating, brownish bands, reaching below middle of sides, the first about below the third dorsal spine, the second below the 7th-8th spines, the third below the 11th-12th spines, the fourth below the third or fourth dorsal rays. Length 64 mm. (After Bleeker, not seen by me).

Habitat: Singapore; Celebes (Menado); New Guinea (Wilhelm Hafen). — Riu Kiu Islands, Formosa, Philippines, New Britain.

Note. The type of the species seems to be lost. Bleeker says (translated): "This species is built after the type of *Amphacanthus corallinus* C. V., but its profile is still more acute, the caudal less incised, and the body without spots. It can further be recognized by the length of the 9th and 10th dorsal spines compared with the other spines, by the upward branches of the tubes of the lateral line, and by the 4 transverse twin bands". Herre & Montalban (l.c.) doubted the validity of this species and said that it is probably a colour phase of *Teuthis concatenata* (= *Siganus guttatus*). On p. 158 of the paper cited they say that a badly frightened living specimen (of *concatenata*) in the aquarium changed its colour, so that it was darker and had four very large irregular dark brown spots above the middle of the side, and four dark brown bars inclined diagonally downward and forward across the whole width of dorsal and upon back below its base, alternating with the lateral spots, and a broad brown bar from origin of dorsal across eye to top of lip and middle of snout, where it joined its fellow from the other side. When marked it this way it was much like *T. tetrazona* (Blkr). Later Herre changed his opinion, for in his paper of 1934, cited above, he says: "apparently a valid species".

It seems to be restricted to the Western coasts of the Pacific.

4. **Siganus rostratus** (C. V.)

?*Amphacanthus argenteus* Quoy & Gaimard, Voyage Uranie et Physicienne, Zool. 1824, p. 368.

Amphacantnus rostratus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 158.
?*Amphacanthus argenteus* Cuvier & Valenciennes, ibid. p. 161.
Amphacanthus Kopsii Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 483.
Teuthis rostrata Playfair, Fishes of Zanzibar, 1866, p. 50.
Amphacanthus rostratus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 503.
Teuthis rostrata Günther, Fische der Südsee I, 1873-1875, p. 89.
?*Teuthis argentea* Günther, ibid. p. 90.
Tetuhis rostrata Klunzinger, Fische des Rothen Meeres I, 1884, p. 76.
Teuthis rostrata Waite, Mem. Austr. Mus. III, 1899, p. 187.
Siganus rostrata Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 111.
Teuthis rostrata Steindachner, Denkschr. Akad. Wien LXXI, 1902, p. 140.
Amphacanthus argenteus M. Weber, Siboga Exp. Fische, 1913, p. 330 (nec Q. G.?).
Teuthis rostrata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 161.
Siganus rostratus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 283.
?*Siganus argenteus* Fowler, l.c.
Siganus rostratus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 310.
Siganus rostratus Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 347.
Teuthis rostrata Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 252.

D. XIII. 10. A. VII. 9. P. 2. 16. V. I. 3. I. Ll. 170-200. Ltr. $\begin{array}{c}18\text{-}19\\ \hline 1\\ \hline 88\text{-}95\end{array}$.

Height 2.4-2.7, 3.1-3.4 in length with caudal. Head 4.2-4.5, 5.2-5.7 in length with caudal. Eye 3.2-4.1, 1.3-1.7 in snout and 1.1-1.3 in the very slightly convex interorbital space. Anterior nostril with a posterior flap, reaching to the posterior nostril in young ones, not so far in adults. Cheeks with some scattered scales anteriorly, otherwise naked. First dorsal spine equal to eye, seventh dorsal spine slightly longer than those anterior to it, equal to snout or one third diameter of eye longer. Spines behind the tenth rapidly diminishing in size, the last spine shorter than the first one. Soft dorsal rounded, the median rays not much longer than the anterior ones, the posterior ones gradually decreasing in size, the last half length of the longest median one, which equals length of longest spine. First anal spine longer than first dorsal one, fourth anal spine somewhat longer than the spines before it, as long as longest dorsal spine. Three last spines rapidly decreasing in size, the last less than eye. Lower border of anal slightly rounded, almost straight, the anterior rays subequal, equal to eye in length, the posterior ones shorter. Pectorals equal to snout and eye or somewhat longer, ventrals shorter, as long as head without snout. Caudal deeply forked, the median rays at least half length of the outer one. Caudal peduncle slender, its least height 1.4-1.5 in eye. Colour of preserved specimens brown, sides with scattered dark brown spots. An indistinct dark brown streak along hindborder of opercle. In a young specimen the lower sides of the head, body, and tail show faint longitudinal somewhat wavy broken white lines. Still younger ones are distinctly silvery below. Spinous dorsal and anal clouded with brown, membranes of soft dorsal and anal hyaline, the rays ringed darker and lighter brown. Caudal brown, with indistinct dark brown transverse bands, interrupted in the middle. Length 346 mm.

Habitat: Java (Jacarta); Biaru!; Ambon!; Sulu Islands; New Guinea (Manokwari, Moresby Bay). — Mozambique, Zanzibar, Red Sea, Coast of South Arabia, Seychelles, Riu Kiu Islands, Philippines, Pelew Islands, Marianas, Marshall Islands, Carolines, New Britain, Solomon Islands, New Hebrides, Gilbert Islands, Funafuti, Fiji, Samoa, Cook Islands, Society Islands. In sea.

Note. I have examined a typical specimen of *Amphacanthus kopsii* from Bleeker's collection in the Leiden Museum. It agrees in all points with *rostratus,* excepting the colour, which has faded now but which Bleeker describes as greenish brown above, yellowish margaritaceous below, the back and sides spotted with margaritaceous or yellowish. Spinous dorsal and anal edged with black, rays of dorsal and anal variegated with brownish. Bleeker describes the caudal as "truncata, angulis acuta" but in reality it is forked.

The specimens mentioned by Weber (l.c.) as *argenteus* Q. G. belong to *rostratus,* but I am not sure that it is the same as that described by the French authors. *Amphacanthus argenteus* Q. G. was based on a small specimen of a little more than 50 mm length. It is more elongate than Weber's specimens, but this may be due to its young age. Quoy & Gaimard say that it may be the young of *marmoratus* (= *spinus)* and according to Cuvier & Valenciennes at Guam, where Quoy & Gaimard found the species to be very abundant at some times of the year, the natives too consider it to be the young of *marmoratus.*

5. **Siganus spinus** (L.). (Fig. 22, p. 106).

Sparus spinus Linné, Syst. Nat. Ed. 10. 1758, p. 281.
Scarus siganus; *rivulatus* Forskål, Descr. Animal. 1775, p. 25.
Amphacanthus marmoratus Quoy & Gaimard, Voyage Uranie et Physicienne, Zool. 1824, p. 367.
Amphacanthus nebulosus Quoy & Gaimard, ibid. p. 369.
Amphacanthus maculosus Quoy & Gaimard, ibid. p. 370.

Amphacanthus marmoratus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 125.

Amphacanthus nebulosus Cuvier & Valenciennes, ibid. p. 164.

Amphacanthus gymnopareius Richardson, Ann. Mag. Nat. Hist. XI, 1843, p. 174.

Amphacanthus scaroides Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 262.

Teuthis striolata Günther, Cat. Brit. Mus. III, 1861, p. 319.

Teuthis nebulosa Günther, ibid. p. 321.

Teuthis marmorata Günther, ibid. p. 322.

Amphacanthus marmoratus Kner, Novara Exp. Fische I, 1865-1867, p. 208.

Teuthis nebulosa Playfair, Fishes of Zanzibar, 1866, p. 51.

Amphacanthus nebulosus Steindachner, Sitzber. Akad. Wiss. Wien LIII, Abth. I. 1866, p. 457.

Amphacanthus sigan Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 502.

Teuthis striolata Günther, Fische der Südsee I, 1873-1875, p. 89.

Teuthis marmorata Günther, ibid. p. 90.

Teuthis marmorata Day, Fishes of India, Part I, 1875, p. 166.

Amphacanthus sigan, Kossmann & Räuber, Verh. Naturk. Med. Vereins Heidelberg I, 1876, p. 31. — Zool. Ergebnisse. Pisces, 1877, p. 22.

Teuthis nebulosa Macleay, Descr. Cat. Austr. Fishes I, 1881, p. 144.

Teuthis sigan Klunzinger, Fische des rothen Meeres I, 1884, p. 75.

Teuthis siganus Sauvage, Poissons de Madagascar, 1891, p. 287.

Teuthis marmorata Steindachner, Abh. Senckenb. naturf. Ges. XXV, 1901, p. 426.

Siganas marmorata Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 111.

Teuthis sigan Steindachner, Denkschr. Akad. Wien LXXI, 1902, p. 140.

Siganus marmoratus Jordan & Seale, Bull. Bur. Fish. XXV (1905), 1906, p. 359. — ibid. XXVI (1906) 1907, p. 35.

Siganus marmoratus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 271.

Siganus marmoratus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 511.

Amphacanthus marmoratus M. Weber, Siboga Exp. Fische, 1913, p. 329.

Amphacanthus striolatus de Beaufort, Bijdr. Dierk. Afl. 19, 1913, p. 126.

Siganus nebulosus McCulloch, Austr. Zoologist II, Part III, 1922, p. 108.

Siganus nebulosus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 785.

Teuthis marmorata Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 567.

Siganus rivulatus Fowler & Bean, Proc. U. S. Nat. Mus. LXXI, Art. 10, 1927, p. 14.

Amphacanthus nebulosus Whitley, Rec. Austr. Mus. XVI, 1928, p. 232.

Siganus rivulatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 282.

Teuthis striolata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 177.

Siganus spinus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1928, p. 320.

Siganus nebulosus McCulloch, Checklist Fish. Austr. Part II, 1929, p. 271.

Siganus rivulatus Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXIII, 1931, p. 248.

Teuthis striolata Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 258.

Siganus spinus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 147, p. 173.

Siganus spinus L. P. Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 137.
?*Teuthis siganus* Blegvad, Danish Sc. Inv. Iran. Part III, 1944, p. 154.

D. XIII. 10. A. VII. 9. P. 2. 14-15. V. I. 3. I. Sq. l. 165-175. Ltr.
17-18
1 .
70

Height 2.5-2.8, 3-3.3 in length with caudal. Head 3.7-3.9, 4.4-4.8 in length with caudal. Eye 2.7-3.2, 1.1-1.2 in snout. Interorbital space flat, 1.2-1.3 in eye. Cheeks with a few deciduous scales, imbedded in the skin. Anterior nostril with a long flap, longer than distance between anterior and posterior nostrils. First dorsal spine somewhat less than eye. Seventh or eighth spines longest, equal to snout and half eye or slightly more. Last spine equal to eye. Soft dorsal rounded, the median rays longest, equal to snout and eye. First anal spine longer than first dorsal one; following spines subequal, one half or one third diameter of eye longer than snout, excepting the last which equals snout in length. Pectorals about half length of snout shorter than head. Ventrals equal to head without snout. Caudal slightly emarginate, almost truncate when the fin is expanded. Caudal peduncle slender, its least depth 1.6-1.7 in its length, and 1.4-1.6 in eye. Colour of preserved specimens brownish above, lighter, sometimes whitish or silvery, below. More or less distinct white lines, narrower than the interspaces, sinous or curled, often anastomosing or broken into short stripes, in a more or less transverse direction on the back and longitudinal on the sides; transverse on caudal peduncle and forming here with the ground colour vertical bars, which are continued on the outer

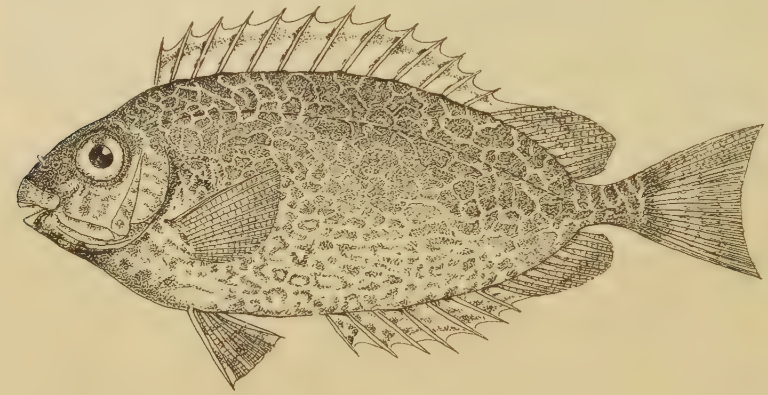

Fig. 22. *Siganus spinus* (L.) × 1/2.

rays of the caudal. Chin also barred transversely white and brown, these bars broader than the lines on body and tail. Sometimes there are indications of large darker brown blotches along the base of the dorsal. Fins more or less mottled with brown and white. Length 260 mm.

Habitat: Pulu Weh!; Sumatra (Kauer, Benkulen, Trussan, Padang, Ulakan, Priaman, Tapaktuan!); Java (Patjitan, Karangbollong, Prigi); Bali; Bawean; Borneo (Sarawak, South East Coast); Celebes (Badjoa, Menado, Tombariri); Sangir Islands!; Sulu Islands; Ternate; Obi major!; Batjan; Buru; Ceram; Ambon!; Haruko; Goram; Banda!; Timor; Kei Islands!; Aru Islands; Waigeu!; Schouten Islands; New Guinea. — Coast of Natal, Madagascar, Zanzibar, Red Sea, Mauritius, Persian Gulf, Arabian Sea, Coast of India, Ceylon, Andamans, Japan, Riu Kiu Islands, Philippines, Marianas, Carolines, Bismarck Archipelago, Solomon Islands, Coasts of Queensland and New South Wales, New Hebrides, Gilbert Islands, Fiji, Samoa, Society Islands. In sea.

Note. Norman (Proc. Zool. London, Part 4, 1929, p. 615) records this species from Cyprus, which it probably reached via the Suez Canal.

6. **Siganus oramin** (Bl. Schn.)

Amphacanthus guttatus. var. *oramin* Bloch Schneider, Syst. Ichth. 1801, p. 207.
Amphacanthus dorsalis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 143.
Amphacanthus margaritiferus Cuvier & Valenciennes, ibid. p. 145.
Amphacanthus tumifrons Cuvier & Valenciennes, ibid. p. 159.
Amphacanthus dorsalis Schlegel & Müller, Verh. nat. gesch. Ned. overz. bezit. Zool. 1839-1844. Beschr. Amphacanthus, p. 10.
Amphacanthus margaritiferus Schlegel & Müller, l.c.
Amphacanthus albopunctata Schlegel, Fauna Japonica, Pisces, 1842, p. 128.
Amphacanthus margaritiferus Richardson, Rep. Fifteenth Meeting Br. Ass. Adv. Sc. (1845), 1846, p. 243.
Amphacanthus fuscescens Richardson, l.c. (nec Houttuyn).
Teuthis dorsalis Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1191.
Amphacanthus dorsalis Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. Teuthiden, p. 9. — Nat. Tijdschr. Ned. Indië XIII, 1857, p. 332.
Amphacanthus margaritiferus Bleeker, ibid. 1857, p. 334.
Teuthis margaritifera Günther, Cat. Br. Mus. III, 1861, p. 317.
Teuthis dorsalis Günther, ibid. p. 318.
Teuthis albopunctata Günther, l.c.
Amphacanthus albopunctatus Kner, Novara Exp. Fische I, 1865-1867, p. 206.
Amphacanthus mertensi Kner, l.c.
Amphacanthus margaritiferus Kner, l.c.

Teuthis margaritifera Playfair, Proc. Zool. Soc. London 1867, p. 855.
Teuthis albopunctata Günther, Fische der Südsee I, 1873-1875, p. 88.
Teuthis margaritifera Day, Fishes of India, Part I, 1875, p. 167.
Teuthis oramin Day, ibid. p. 168.
Teuthis albopunctata Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 143.
Teuthis albopunctata Steindachner & Döderlein, Denkschr. Akad. Wien XLVIII, 1883, p. 25.
Siganus albopunctatus Rutter, Proc. Acad. Nat. Sc. Philadelphia 1897, p. 7
Siganus fuscescens Jordan & Evermann, Proc. U. S. Nat. Mus. XXV, 1902, p. 359 (nec Houttuyn).
Teuthis oramin Johnstone, Pearl oyster Rep. II. Fishes, 1904, p. 217.
Teuthis albopunctata Steindachner, Sitzber. Akad. Wien CXV, 1906, p. 1394.
Siganus fuscescens Smith & Pope, Proc. U. S. Nat. Mus. XXXI, 1906, p. 481 (nec Houttuyn).
Siganus fuscescens Jordan & Seale, Bull. Bur. Fish, XXVI (1906) 1907. p. 35 (nec Houttuyn).
Siganus oramin Jordan & Richardson, ibid. XXVII (1907) 1908, p. 271.
Amphacanthus oramin M. Weber, Siboga Exp. Fische 1913, p. 329.
Siganus fuscescens Fowler & Bean, Proc. U. S. Nat. Mus LXII, 1922, Art. 2, p. 58.
Siganus oramin Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 785.
Teuthis oramin Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 165.
Siganus canalicutatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 279.
Siganus albopunctatus Fowler, ibid. p. 281.
Siganus oramin Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 307.
Siganus fuscescens Fowler & Bean, ibid. p. 314 (nec Houttuyn).
Siganus oramin Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 155.
Teuthis oramin Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p 254.

D. XIII. 10 (11). A. VII. 9 (10). P. 2. 14. V. I. 3. I. Ll. 180-200. Ltr. $\begin{array}{c} 20\text{-}23 \\ \hline 1 \\ \hline 97\text{-}104 \end{array}$.

Height 2.4-2.8, 2.9-3.5 in length with caudal. Head 3.7-3.8, 4.4-5.1 in length with caudal. Eye 3-3.9, 1.2-1.6 in snout and about equal to very slightly convex interorbital space. Anterior nostril with a low brim, sometimes produced into a very short flap at its posterior border. Cheeks naked or with a few scattered scales. First dorsal spine equal to eye or somewhat longer in young specimens. Seventh or seventh and eighth spines longest, equal to snout and half eye. Last spine equal to or somewhat less than first one. Soft dorsal rounded, the median rays not much longer than the anterior ones, equal to snout, in young specimens equal to snout and half eye. First anal spine somewhat longer than first dorsal spine. Third, fourth, and fifth spines subequal, as long as distance between anterior border of pupil and tip of snout. Last anal spine about as long as first. Soft anal similar to soft dorsal. Pectorals as long as snout and eye, ventrals shorter. Caudal forked in adults, in young ones almost truncate. Colour of preserved specimens brownish above, more or less silvery below. Head, body, and tail covered with numerous white spots, smaller than interspaces, generally smaller and rounded on head and nape, longer and more elongate on sides. These spots indistinct in formol specimens. A more or less distinct dark blotch immediately behind head and below origin of lateral line. Young with a few dark transverse bands on chin. Membranes of spinous dorsal and anal with dark brown cloudy blotches or oblique bands, the spines often with similar white spots as the body. Membranes of soft dorsal and anal hyaline, the rays ringed with darker. Pectorals yellowish. Ventrals with brown markings. Caudal brown, with more or less distinct vertical bands, interrupted in the middle. Length 280 mm.

Nomen indig. Bonang-Bonang (Malay).

Habitat:Singapore; Sumatra (Benkulen, Padang!, Siboga); Batu Islands; Nias; Biliton; Banka; Java (Jakarta!, Karangbollong); Bawean; Bali; Borneo (Sandakan, Bontang!); Birabirahan Islands; Si Amil Island; Celebes (Makassar!, Badjoa, Menado, Kait Point, Libani Bay); Limbe Strait; Sulu Islands; Halmahera; Ternate; Batjan; Ambon!; Ceram; Goram; Sumbawa; Timor; Aru Islands!; New Guinea (Dörper-Spitze, Moresby Bay). — Natal and Zululand Coast, Madagascar, Zanzibar, Seychelles, Mauritius, Coast of Arabia, Coasts of India, Andamans, Burma, Siam, Malacca, Indochina, China, Japan. Riu Kiu Islands, Formosa, Philippines, Pelew Islands, Carolines, Admirality Islands, Bismarck Archipelago, Solomon Islands, Santa Cruz Islands, Coasts of North Australia, Fiji, Samoa. In sea.

Note. The description and figure of *Amphacanthus guttatus* var. *oramin* by Bloch Schneider is so poor, that it remains doubtful if it represents the species described above, but as it has generally been accepted by recent authors I have adopted it. I agree with Herre and Montalban that *Amphacanthus margaritiferus* and *dorsalis* of Cuvier & Valenciennes belong to this species, as well as *albopunctatus* Schlegel. I have no doubt that *tumifrons* C. V. is another synonym. The depth of the body is variable in this species, but the greater or lesser slenderness is not correlated with the size of the white dots, the presence or absence of a dark shoulder spot, or the form of the caudal fin, which is almost truncate in young, getting more and more emarginate with age and distinctly forked in adults.

7. **Siganus fuscescens** (Houttuyn)

Centrogaster fuscescens Houttuyn, Verh. Holl. Maatsch. Weetensch. XX. 2. Stuk 1782, p. 333.
Amphacanthus fuscescens Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 156.
Amphacanthus fuscescens Schlegel, Fauna Japonica, Pisces, 1845, p. 127.
Amphacanthus fuscescens Bleeker, Verh. Bat. Gen. XXVI, 1854-1857. Nieuwe Nalez. Ichth. Japan, p. 106.
Teuthis fuscescens Klunzinger, Sitzber. Akad. Wien, 1880, p. 393.
Siganus fuscescens Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 560.
Teuthis fuscescens Steindachner & Döderlein, Denkschr. Akad. Wien XLVIII, 1883, p. 25.
Teuthis fuscescens Franz, Abh. Bay. Akad. IV. Suppl. Bd. 1 Abh., 1910, p. 50.
Siganus fuscescens Seale, Philipp. Journ. Sc. V, N° 4, 1910, p. 284.
Teuthis fuscescens Jordan & Hubbs, Mem. Carnegie Mus. X, 1922-1925, p. 253.
Teuthis fuscescens Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 154.
Teuthis fuscescens P. J. Schmidt, Trans. Pac. Comm. Ac. Sc. USSR I, 1930, p. 104. — Bull. Acad. Sc. URSS, 1930, p. 557.
Siganus fuscescens Fowler, Hongkong Nat. 6. Suppl. 1938, p. 35.

D. XIII. 10. A. VII. 9. P. 2.15. V. I. 3. I. Sq. l. about 270.

Ltr. $\begin{array}{c}25\text{-}30\\ \hline 1\\ \hline 120\end{array}$.

Height 2.4-2.5, 2.9-3.1 in length with caudal. Head 4-4.1, 4.8-5 in length with caudal. Eye 3.1-3.5, 1.3-1.5 in snout and equal to slightly convex interorbital space. Anterior nostril with a short flap, much shorter than distance between anterior and posterior nostrils in adults, but longer in young ones. Cheeks naked or with a few scales imbedded in the skin. First dorsal spine equal to eye, seventh spine longest, about equal to snout and half eye. Last spine as long as first one. Soft dorsal rounded, the median rays not much longer than the anterior ones, somewhat more than snout; the posterior rays decreasing gradually in height, the last one less than eye. First anal spine slightly longer than eye, fourth spine longest, equal to snout. Last spine slightly longer than first one. Soft anal slightly rounded, less deep than soft dorsal. Pectorals half length of snout shorter than head. Ventrals about as long as snout and half eye. Caudal forked, lunate when the fin is expanded. Least depth of caudal peduncle 1.3 in its length, 1.2-1.4 in eye. Colour of preserved specimens chocolate brown, with scattered dark rather large spots. Dorsal spines brown, the membranes hyaline clouded with brown. Dorsal rays annulated light and dark brown, the membranes hyaline. Pectorals yellowish, brown at base. Ventrals, anal, and caudal brownish. Length 350 mm. (Specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Singapore!; Nias!; Java (Jacarta!); Borneo (Sandakan!); Buton!; New Guinea. — Mozambique!, Réunion, China, Japan, Riu Kiu Islands, Formosa, Philippines, Pelew Islands, Marcus Island, New Britain, Howland Island, Saipan, Queensland, Samoa. In sea.

8. **Siganus javus** (L.). (Fig. 23, p. 112).

Teuthis javus Linné, Syst. Nat. Ed. 12. I. 1766, p. 507.
Amphacanthus javus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 118.
Amphacanthus Russelii Cuvier & Valenciennes, ibid. p. 123.
Amphacanthus javus Schlegel & Müller, Verh. nat. gesch. Ned. overz. Bezitt. Zool. 1839-1841. Beschr. Amphacanthus, p. 10.
Amphacanthus Russelii Bleeker, Nat. Geneesk. Arch. Ned. Indië II, 1845, p. 515.
Teuthis java Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1189.
Amphacanthus javus Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. Teuthieden, p. 9.
Teuthis javus Günther, Cat. Brit. Mus. III, 1861, p. 315.
Amphacanthus javus Kner, Novara Exp. Fische I, 1865-1867, p. 205.
Teuthis java Day, Fishes of India, Part I, 1875, p. 165.
Teuthis Javus Castelnau, Proc. Linn. Soc. New S. Wales III, 1879, p. 386.
Teuthis javus Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 142.
Siganus javus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 35.
Siganus javus Evermann & Seale, ibid. p. 98.
Siganus javus Jordan & Richardson, ibid. XXVI (1907) 1908, p. 271.
Siganus javus Seale, Philipp. Journ. Sc. V. N° 4, 1910, p. 283.
Siganus javus Fowler & Bean, Proc. U. S. Nat. Mus. LXII, 1922, Art. 2, p. 57.
Siganus javus Mc Culloch, Austr. Zoologist II, Part III, 1922, p. 108.
Teuthis javus Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 175.
Siganus javus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 279.
Siganus javus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 291.

D. XIII. 10. A. VII. 9. P. 2.14-16. V. I. 3. I. Sq. l. about 200

Ltr. $\begin{array}{c}30\text{-}35\\ \hline 1\\ \hline 120\text{-}130\end{array}$.

Height 1.8-2.2, 2.3-2.8 in length with caudal. Head 3.4-3.7, 4.3-4.6 in length with caudal. Eye 3.1-3.3, 1.2-1.3 in snout and 1-1.2 in somewhat convex interorbital space. First dorsal spine as long as eye, following spines increasing in length to the sixth, which equals snout and half eye; seventh and following spines decreasing again in length, the last equal to snout. Soft dorsal angular, post-median rays longest, about equal to snout and half eye. First anal spine longer than eye, third spine longest, as long as snout and half eye, posterior spines subequal, slightly less than third. Soft anal somewhat more rounded than soft dorsal. Pectorals equal to head without snout or somewhat longer. Ventrals slightly shorter than pectorals.

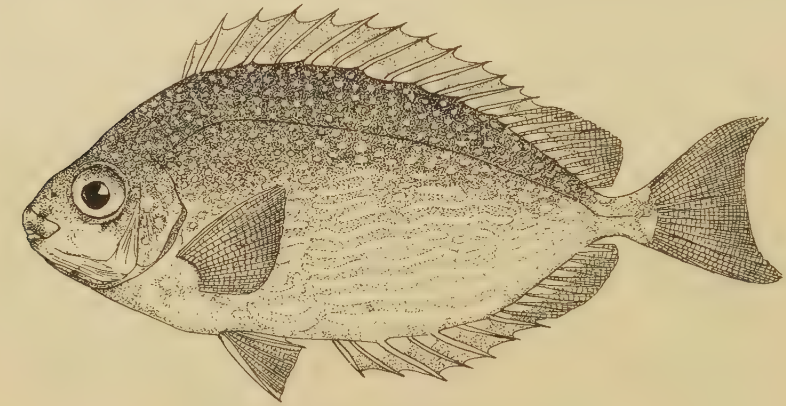

Fig. 23. *Siganus javus* (L.) × $^5/_9$.

Caudal truncate in young, emarginate in adults. Least depth of caudal peduncle 1.2-1.4 in its length, 1.2-1.3 in eye. Colour of preserved specimens brown, generally lighter or somewhat silvery on sides of head, thorax, belly, and lower parts of body and tail. Back with light spots, confluent into lateral stripes on upper part of sides and forming longitudinal, more or less anastomosing bands lower down. In older specimens these bands are more developed, as broad as interspaces, and developed also on upper part of sides; on back and nape only as spots. Sides of head sometimes with light spots. Dorsal, anal, caudal and ventrals generally brown; pectorals light yellowish. Length 333 mm.

Nomen indig. Bronang-bronang (Malay). Samadar, Madar (Samarang). Limaran (Javanese), Masadar (Madurese).

Habitat: Singapore!; Riouw; Bintang; Sumatra (Coast of Deli, Siboga, Padang, Benkulen); Nias!; Banka; Java (Jacarta!, Cheribon!, Samarang, Japara, Surabaya, Pasuruan); Bali; Borneo (Stagen!, Sandakan, Balikpapan!); Sibuti Island; Celebes (Makassar!, Badjoa); Makjan Island; Ambon; Waigeu!; New Guinea. — Muscat, Coast of India, Ceylon, Andamans, Siam, Malay Peninsula, Indochina, Philippines, Pelew Islands, Coast of Australia to New South Wales, New Hebrides, Tahiti.

In sea, brackish, and fresh water.

9. **Siganus virgatus** (C. V.)

Amphacanthus virgatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 133.
Amphacanthus virgatus Schlegel & Müller, Verh. Nat. gesch. Ned. overzee. bezit. Zool. 1839-1844. Beschr. Amphacanthus, p. 11.
Amphacanthus virgatus Bleeker, Verh. Bat. Gen. XXIII, 1850. Teuthiden, p. 11.
Teuthis virgata Günther, Cat. Brit. Mus. III, 1861, p. 323.
Amphacanthus virgatus Kner, Novara Exp. Fische I, 1865-1867, p. 209.
Amphacanthus virgatus? Jouan, Mém. Soc. Sc. nat. Cherbourg XII, 1866, p. 124.
Teuthis virgata Day, Proc. Zool. Soc. London 1870, p. 687. — Fishes of India, Part I, 1875, p. 166.
Siganus virgatus Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 562.
Siganus virgatus Evermann & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 98.
Siganus virgatus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 271.
Teuthis virgata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 171.
Siganus virgatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 327.
Amphacanthus virgatus Whitley, Rec. Austr. Mus. XVII, N° 3, 1929, p. 126.

D. XIII. 10 (11). A. VII. 9. P. 2. 14. V. I. 3. I. Ll. 140-150.

Ltr. $\begin{array}{c} 20\text{-}22 \\ \hline 1 \\ \hline 93\text{-}94 \end{array}$.

Height 1.9-2.2, 2.4-2.6 in length with caudal. Head 3.6-3.7, 4.4-4.7 in length with caudal. Eye 3.1-3.5, 1.3-1.6 in snout, and 0.9-1.1 in slightly convex interorbital space. Anterior nostril with a fleshy brim, higher posteriorly and suggesting a small flap. Cheek scales deciduous. First dorsal spine less than eye, fifth spine longest, equal to snout and half eye; last spine only slightly shorter. Soft anal high, angular, the median rays much the longer and slightly longer than longest spine. First anal spine longer than eye, third or third and fourth spines slightly longer than the others, as long as snout and half eye. Soft anal similar to soft dorsal, but somewhat less deep. Pectorals slightly shorter than head, ventrals somewhat shorter than snout and eye. Caudal emarginate or slightly forked. Least height of caudal peduncle about equal to eye. Colour of preserved specimens brownish. Ten to twelve narrow dark cross bands on snout, interorbital space, and occiput, followed on nape by irregular short stripes and round dark spots, lastnamed also scattered on anterior part of back. A dark brown band from chin through eye to origin of dorsal. A similar band, tapering inferiorly, from between third to fifth dorsal spines to above base of pectoral; these bands more or less bordered by black lines, blue in life. In life the space between the two bands is white, and a band of the same colour borders the second dark band posteriorly. In preserved specimens the dark bands often fade. Dorsal and anal dusky, the soft portions of the fin with a light longitudinal basal band. Caudal dusky. Pectorals and ventrals yellowish. Length 275 mm.

Nomen indig. Ikan bronang-bronang.

Habitat: Singapore; Bintang; Sumatra (Telokbetong, Priaman, Padang); Biliton; Banka; Java (Jacarta); Duizend Islands; Bawean; Borneo (Sandakan, Bontang!); Birabirahan Island; Sulu Islands; Celebes (Makassar, Badjoa); Basa Island and Labuandatat Bay, Gulf of Boni; Tana Keke Island; Great Tobea; Talisse; New Guinea. — Andamans, Siam, China, Japan, Riu Kiu Islands, Formosa, Pulu Condor, Philippines, North Australia. In sea.

10. **Siganus doliatus** (C. V.)

Amphacanthus doliatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 132.
Amphacanthus doliatus Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 605.
Amphacanthus doliatus Kner, Novara Exp. Fische I, 1865-1867, p. 209.
Teuthis doliata Günther, Fische der Südsee I, 1873-1875, p. 90.
Teuthis doliata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 173.
Siganus doliatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 284. — ibid. XI, N° 5, 1931, p. 347.— ibid. N° 6, 1934, p. 429.
Siganus doliatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 324.
Teuthis doliata P. J. Schmidt, Trans. Pac. Comm. Acad. Sc. USSR I, 1930, p. 105.
Teuthis doliata Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 257.

D. XIII. 10. A. VII. 9. P. 2. 14. V. I. 3. I. Ll. about 158. Ltr. $\begin{matrix}22\\1.\\96\end{matrix}$

Height 2.1, 2.6 in length with caudal. Head 3.9, 4.9 in length with caudal. Eye 3.4, 1.5 in snout and 1.2 in slightly convex interorbital space. Anterior nostril with a low rim. Cheek scales deciduous. First dorsal spine equal to eye. Fifth spine longest, equal to snout and half eye, last one equal to snout. Soft dorsal high, angular, the median rays longest, and as long as snout and eye. First anal spine almost equal to length of snout, last spine longest, one half diameter of eye longer than snout. Soft anal similar to soft dorsal, but somewhat less deep. Pectorals one third of snout shorter than head. Ventrals equal to snout and half diameter of eye. Caudal emarginate. Colour of preserved specimen brownish. Head and anterior part of body with light sinous bands, bordered with narrow dark lines, forming cross bars on snout. Behind the pectorals these bands are arranged as crowded vertical parallel bands; on posterior half of tail they are dissolved into short stripes, which are bent in a horizontal direction and form longitudinal bars on caudal peduncle. Fins hyaline. Length 255 mm (A specimen of Bleeker's collection in the Leiden Museum examined).

Habitat: Talisse Island; Halmahera; Tidore; Ternate; Makjan; Batjan; Buru; Ceram; Timor; New Guinea (Manokwari, Port Moresby). — Riu Kiu Islands, Philippines, Pelew Islands, Carolines, New Britain, Woodlark Island, Solomon Islands, Santa Cruz Islands, Coast of Queensland, New Hebrides, Fiji, Society Islands. In sea.

Note. Fowler & Bean have expressed their doubt, if this species can be separated from *virgatus,* as they had specimens which are intermediate in colour pattern.

11. **Siganus canaliculatus** (Mungo Park. Blkr)

?*Chaetodon canaliculatus* Mungo Park, Linn. Trans. III, 1797, p. 33.
Amphacanthus canaliculatus Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 580.
Teuthis canaliculatus Günther, Cat. Brit. Mus. III, 1861, p. 316.

D. XIII. 10. A. VII. 9. P. 2. 14. V. I. 3. I.

Height $2^2/_3$-$2^3/_4$. Head $4^2/_3$-$4^3/_4$. Eye about 3. Median dorsal spines longest, the first spine much shorter than the last one. Soft dorsal angular, higher than spinous part. Median anal spines longest. Pectorals shorter than head. Caudal slightly emarginate. Greyish green above, bluish and greenish margaritaceous below. Forehead and snout with transverse blue bands. Back and sides with numerous blue spots. Fins orange and green. Ventrals and pectorals lighter. Length 195 mm.

Habitat: Sumatra (Padang, Trussan).

Note. Mungo Park's description of *canaliculatus* is too short to be of much value, and Bleeker was not at all sure that his species was the same as that of Park. He based the identity chiefly on the fact, that both specimens came from the same locality, what is a very poor argument indeed. Cuvier & Valenciennes (Hist. Nat. Poissons X, 1835, p. 146) united *canaliculatus* Park with their *margaritaceous,* but Bleeker has already pointed out that lastnamed species, which I consider to be a synonym of *oramin,* is quite different from *canaliculatus* as described by him. Most authors have followed Cuvier & Valenciennes and it seems that *canaliculatus* Blkr has never been found again. As Bleeker remarked, it is near *virgatus,* differing in being more slender and in missing the two dark transverse bands on head and anterior part of body. These bands are often indistinct in preserved specimens, and it is not impossible that *canaliculatus* Blkr is based on rather deep-bodied specimens of *virgatus*. I have seen the typical specimens of Bleeker's collection in the Leiden Museum; they have lost all colour or markings.

12. **Siganus puellus** (Schl.)

Amphacanthus puellus Schlegel, Bijdr. Dierk. I. Afl. 5. Afd. I. 1852, p. 39.
Amphacanthus cyanotaenia Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 606.
Amphacanthus puellus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII, 1860. Dertiende bijdr. visch. Celebes, p. 36.
Teuthis puella Günther, Cat. Brit. Mus. III, 1861, p. 323. — Fische der Südsee I, 1873-1875, p. 91.
Siganus zoniceps Seale, Occas. Papers B. P. Bishop Mus. IV, 1906, p. 69.
Siganus puellus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 284.
Teuthis puella Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 169.
Siganus puellus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 325.
Teuthis puella Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 256.

D. XIII. 10. A. VII. 9. P. 2. 13. V. I. 3. I. Ll. about 170. Ltr.

$$\frac{18}{\frac{1}{88\text{-}100}}.$$

Height 2.3-2.4, 3.1 in length with caudal. Head 3.5-3.6, 4.5-4.9 in length with caudal. Eye 3.3-3.8, 1.5-1.8 in snout, and 1-1.3 in very slightly convex interorbital space. First dorsal spine equal to eye, fourth to sixth spines longest, equal to snout. Soft dorsal pointed, median rays longest, equal to snout and half eye. First anal spine somewhat more than eye, fifth to seventh spines longest, less than snout. Soft anal similar to soft dorsal. Pectorals equal to snout and eye. Ventrals as long as snout. Caudal forked. Caudal peduncle about as long as deep, its least depth equal to eye or a little less than eye. Colour of preserved specimens light reddish brown above, silvery with a bluish hue below. About 8 bluish or brownish narrow transverse bands on anterior part of body, deflected on belly, the hinder ones turned here into longitudinal, more or less wavy and anastomosing bands. Similar longitudinal bands on body and tail, sometimes broken into spots. A dark band, as broad as diameter of eye, from nape through eye to chin. Dark brown rather large spots on this band above eye. Fins yellowish. Length 300 mm.

Habitat: Java (Jacarta!); Duizend Islands!; Celebes (Makassar!); Sulu Islands; Halmahera; Ternate; Gonomo Island; Ambon; Ceram!; Flores; Banda!; Aru Islands; New Guinea (Port Moresby). — Riu Kiu Islands, Philippines, Pelew Islands, Ponapé, Solomon Islands, Ebon Island, Gilbert Islands, New Hebrides. In sea.

13. **Siganus punctatissimus** Fowler & Bean

Teuthis sutor Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 168 (nec C. V.).

Siganus punctatissimus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 298.

D. XIII. 10. A. VII. 9.

Height 2-2.1. Head 3.3-3.9. Eye 2.7-3.3, 1.2-1.7 in snout and 1-1.2 in convex interorbital space. Anterior nostril with a fleshy rim, which is higher behind. Cheeks scaly. First dorsal spine equal to or less than eye, fifth spine slightly longer than the following, equal to snout and half eye. Last dorsal spine much longer than first one. Soft dorsal angular, the median rays longest. First anal spine longer than first dorsal one. Anal spines increasing in length to the last, which is 1.5-1.6 in head. Soft anal similar to soft dorsal. Pectorals a little shorter than head, ventrals shorter. Caudal forked. Colour of preserved specimens brownish with minute gray dots; in life purplish brown with a minute bright pearl white dot on each scale. A large blackish blotch on shoulder may be present. Vertical fins of same colour as body. Pectorals dull olivaceous. Ventrals pale, with brownish blotches. Length 285 mm (Compiled, not seen by me).

Habitat: Sulu Islands; Talessi Island; Labuandata Bay, Celebes; Halmahera. — China, Philippines. In sea.

Note. The species described by Herre & Montalban as *sutor*, is certainly the same as *punctatissimus* Fowler & Bean. I do not think that *sutor* C. V. is the same species, as Sauvage (Poissons de Madagascar, 1891, p. 289) describes the caudal of the type as emarginate, whereas it is distinctly forked in the present species.

14. **Siganus chrysospilos** (Blkr.)

?*Amphacanthus punctatus* Bloch Schneider, Syst. Ichth. 1801, p. 210.
Amphacanthus chrysospilos Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 66.
Amphacanthus hexagonatus Bleeker, ibid. VII, 1854, p. 41.
Amphacanthus melanospilos Bleeker, ibid. p. 431.
Teuthis hexagonata Günther, Cat. Brit. Mus. III, 1861, p. 320.
Amphacanthus hexagonatus Kner, Novara Exp. Fische I, 1865-1867, p. 207,
Teuthis hexogonata Günther, Fische der Südsee I, 1873-1875, p. 89.
Teuthis sutor Day, Fishes of India, Part I, 1875, p. 167 (nec C. V.).
Teuthis sutor Klunzinger, Sitzber. Akad. Wien LXXX, I. Abth. 1880, p. 393 (nec C. V.).
Siganus hexagonata Seale, Philipp. Journ. Sc. V, N° 4, 1910, p. 284.
Amphacanthus hexagonatus M. Weber, Siboga Exp. Fische 1913, p. 328 (partim).
Siganus hexagonata McCulloch, Austral. Zoologist II, Part III, 1922, p. 108.
Siganus punctatus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 360 (nec Bl. Schn.?).
Teuthis hexagonata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 162.
Siganus sutor Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 280 (nec C. V.).
Siganus punctatus Fowler, ibid. p. 281 (nec Bl. Schn.?).
Siganus sutor Fowler & Bean, Bull. U. S. Nat. Mus. 100, Vol. VIII, 1929, p. 305 (nec C. V.).
Siganus punctatus Fowler & Bean, ibid. p. 312 (nec Bl. Schn.?).
Teuthis hexagonata Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 253.

D. XIII. 10. A. VII. 9. P. 2.14-15. V. I. 3. I. Sq. l. about 180-200. Ltr. $\cfrac{20\text{-}24}{\cfrac{1}{110}}$.

Height 2-2.4, 2.5-3.1 in length with caudal. Head 3.2-4.1, 4.2-5.7 in length with caudal. Eye 3.3-4.5, 1.4-2.2 in snout and 1-1.5 in convex interorbital space. Upper profile of head sloping down in an almost straight line, with a slight convexity at interorbital space, and a slight concavity on snout in large specimens. Nostrils with a low rim, the posterior one larger than the anteror one. In young ones the anterior nostril has a posterior flap, which gradually disappears with age. Cheeks scaly. First dorsal spine slightly more than eye, third to fourth or to sixth spines longest, equal to snout or somewhat longer; last spine slightly shorter, but much longer than first one. Soft dorsal angular, the longest ray equal to snout and half eye, or to snout and eye. First anal spine slightly longer than first dorsal spine, last spine longest, equal to snout and half eye. Soft anal similar to soft dorsal, but slightly more rounded, and the longest ray slightly shorter than longest dorsal ray. Ventrals equal to snout and eye, pectorals somewhat longer. Caudal deeply forked in adults, the upper lobe somewhat longer and somewhat more pointed than the lower one. In young ones the caudal is emarginate. Least height of caudal peduncle 1.2-1.3 in its length, equal to eye in small specimens, more than eye in large ones. Colour of preserved specimens lighter or darker brown. Head, body, and tail covered with light spots of different size, but smaller than pupil; those on lower sides generally smaller than those of back. The spots are relatively larger in young specimens. The interspaces between the spots much less than the spots, and forming a network. In some specimens the spots are darker than the interspaces; this may be due to conservation. A round dark blotch, the size of the eye or larger, at origin of lateral line may be present. This blotch encircled by white in young specimens. Caudal brown, with spots as the body. Spinous dorsal, anal, and ventrals more or less whitish with a broad, brown edge, or variegated with brown. Soft dorsal and anal brown, light with brown dots in young ones. Pectorals yellowish. Length 390 mm (Types of *chrysospilos, melanospilos,* and *hexagonatus* in the Leiden Museum seen by me).

Habitat: Pulu Weh!; Singapore!; Java (Jacarta!); Borneo (Bontang!, Sandakan); Sulu Islands; Biaru!; Celebes (Menado, Kait Point, Libany Bay); Basa Island; Limbe Strait; Talisse Island; Sumbawa; Paternoster Island!; Saleyer!; Obi; Rotti!; Ambon; Gisser!; New Guinea! — Coast of Malabar, Cocos Keeling Islands, Riu Kiu Islands, Philippines, Pelew Islands, Marianas, Solomon Islands, Coast of North Australia, New Caledonia?; Fiji; Samoa; Tonga Islands?

Note. The type of *Amphacanthus chrysospilos* Blkr. agrees with that of *melanospilos,* both differ from the type of *hexagonatus* in being deeper. In the specimen of *chrysospilos,* 345 mm long, the height goes twice in the length, in a specimen of *hexagonatus,* 275 mm long, it goes 2.4 times. Otherwise I see no essential differences.

Some authors have adopted *A. punctatus* Bl. Schn. as the name for this species which is based on a manuscript of Forster, who had called it *Harpurus inermis*. Cuvier & Valenciennes (Hist. Nat. Poissons X, 1835, p. 146) were the first to discuss this species, referring at the same time to a drawing in the Banks library. Lichtenstein (Descr. Animalium 1844, p. 286) when editing Forster's manuscript mentions this drawing, made by Forster's son. Günther (Cat. Brit. Mus. III, 1861, p. 321) who consulted this drawing, says that it well agees with *nebulosa*, but that there is a descrepancy between the description and the drawing, as in the first the fish is described as being spotted all over, whereas in the drawing only the head and the base of the pectorals are thus marked. Later Günther (Fische der Südsee I, 1873-1875, p. 91) again said that it is impossible to give a definite information about *punctatus* (which he calls *guttatus* by mistake). He says that it is possible that the artist omitted to draw the spots on the body. I think it safer to put *punctatus* among the doubtful synonyms.

S. *chrysospilos* is very near *stellatus*, as discussed in a note under that species.

15. **Siganus stellatus** (Forsk.)

Scarus stellatus Forskål, Descr. Animalium 1775, p. 26.
Amphacanthus stellatus Bloch Schneider, Syst. Ichth. 1801, p. 209.
Amphacanthus punctatus Rüppell, Atlas Reise N. Afrika. Fische des rothen Meers, 1828, p. 46 (nec Bl. Schn.).
Amphacanthus nuchalis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 140.
Amphacanthus stellatus Rüppell, Neue Wirbelthiere, Fische des rothen Meeres, 1835, p. 129.
Teuthis stellata Günther, Cat. Mrit. Mus. III, 1861, p. 320.
Amphacanthus stellatus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 503.
Teuthis stellata Day, Fishes of India, Part I, 1875, p. 168 (pro parte?).
Teuthis stellata Klunzinger, Fische des rothen Meeres I, 1884, p. 75, p. 76.
Siganus stellatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 282.
Siganus stellatus Fowler & Bean, Bull. U. S. Nat. Mus. 100, Vol. VIII, 1929, p. 314.

D. XIII. 10. A. VII. 9. P. 21. V. I. 3. I.

Height 2.5. Head about 4. Eye 3.5, almost twice in snout. Upper profile of head sloping down in an almost straight line from dorsal to tip of snout. First dorsal spine slightly more than eye. Third to eighth dorsal spines subequal, about as long as snout and half eye. Last spine equal to snout, much longer than first spine. Soft dorsal angular, the longest rays equal to snout and eye. First anal spine slightly longer than eye, third to seventh anal spines subequal, equal to snout and half eye. Soft anal similar to soft dorsal. Ventrals and pectorals subequal, as long as snout and eye. Caudal deeply forked. Height of caudal peduncle equal to eye. Colour greyish. A large median greenish yellow patch immediately before dorsal. Body and tail, including the patch before dorsal, densely covered with angular brown spots, smaller than the eye. The interspaces between the spots much narrower and forming a network. All fins also spotted, the soft dorsal, the soft anal, and the caudal with yellow hindborders (Compiled, not seen by me). Length 320 mm.

Habitat: Singapore. — Zanzibar, Red Sea, Coast of India, Ceylon, Carolines.

Note. This species seems to be rather common in the Red Sea but it is apparently rare in more eastern localities. It is possible that Day's description is partly based on *S. chrysospilos,* for Day says: "a dark shoulder-spot sometimes present", and this spot is a characteristic of lastnamed species. It is however not impossible that *chrysospilos* does not differ specifically from *stellatus,* or that the species *stellatus* is composed of two geographical forms, a western one with a light blotch before the dorsal and without dark shoulder-spot (*stellatus stellatus*) and an eastern one where this shoulder-spot is present and where the light blotch before dorsal is wanting (*stellatus chrysospilos*).

S. stellatus has been recorded but once from the Indo-Australian Archipelago, viz. by Duncker from Singapore (Mitth. Naturh. Mus. Hamburg XXI, 1904, p. 159).

16. **Siganus vermiculatus** (C. V.)

Amphacanthus vermiculatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 126.

Amphacanthus vermiculatus Schlegel & Müller, Verh. nat. gesch. Ned. overzee. bez. Zool. 1839-1844. Beschr. Amphacanthus, p. 11.

Amphacanthus vermicularis Schlegel & Müller, ibid. Tab. 2, fig. 2.

Amphacanthus vermiculatus Bleeker, Verh. Bat. Gen. XXIII, 1850, Bijdr. Teuthieden, p. 11.

Teuthis vermiculata Günther, Cat. Brit. Mus. III, 1861, p. 317.

Teuthis vermiculata Day, Fishes of India, Part I, 1875, p. 166.

Teuthis vermiculata Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 143.

Siganus vermicularis Jordan & Evermann, Proc. U. S. Nat. Mus. XXV, 1902, p. 359.
Siganus shortlandensis Seale, Occas. Papers B. P. Bishop Mus. IV, 1906, p. 69.
Siganus vermiculatus Seale, Philipp. Journ. Sc. V. N° 4, 1910, p. 283.
Siganus vermiculatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 279.
Teuthis vermiculata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 179.
Siganus vermiculatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 299.
Siganus vermiculatus Fowler, Occas. Papers B. P. Bishop Mus. IX, 20, 1932, p. 9. — Mem. B. P. Bishop Mus. XI, N° 6, 1934, p. 428.
Teuthis vermiculatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 259.

D. XIII. 10. A. VII. 9. P. 2. 14-15. V. I. 3. I. Ll. about 125.

$$\text{Ltr.}\ \begin{array}{c} 20\text{-}24 \\ \hline 1 \\ 93 \end{array}.$$

Height 1.8-1.9, 2.3-2.5 in length with caudal. Head 3.2-3.7, 4-4.5 in length with caudal. Eye 3.2-3.6, 1.4-1.9 in snout, and 1-1.3 in slightly convex interorbital space. First dorsal spine somewhat less than eye. Following spines increasing in length to the seventh, which equals snout or snout and half eye; the spines behind the seventh somewhat shorter, but the last again as long as the seventh. Soft dorsal more or less pointed, the median rays longest, equal to snout and eye or half diameter of eye shorter. First anal spine more than eye, following spines increasing in length to the last, which equals snout or snout and half diameter of eye. Soft anal similar to soft dorsal. Pectorals about half length of snout shorter than head. Ventrals equal to snout and half eye. Caudal emarginate. Caudal peduncle about as long as deep, its least depth somewhat more or less than eye. Colour of preserved specimens light, thorax sometimes silvery. Body and tail, and often also sides of head, covered by brown sinous bands, sometimes as broad as interspaces, sometimes narrower, irregularly curved, often anastomosing, sometimes forming whirls, and arranged into more or less transverse bands on the caudal peduncle, dissolved into rows of spots on the caudal, and also towards the belly, which is without markings. Soft dorsal and anal brown, the rays lighter, often with a dark edge. In one specimen the soft anal has a chalky white longitudinal band in its posterior part. Pectorals yellowish. Ventrals brown. Length 377 mm.

Nomen indig. Bronang-bronang: Samandar; Samar (Samarang). Marang (Simalur).

Habitat: Pulu Weh!; Singapore; Sumatra (Benkulen, Trussan, Padang, Ulakan, Priaman, Siboga); Simalur!; Hinako!; Nias!; Java (Jacarta, Prigi, Samarang, Bay of Baron!); Borneo (Balikpapan!, Sandakan); Celebes (Makassar!, Bulukomba, Badjoa, Menado); Togian Islands; Sangi Islands; Morotai; Halmahera!; Ternate!; Batjan; Buru!; Ambon!; Timor; Waigeu; New Guinea. — Mauritius, Coasts of India, Andamans, Formosa, Philippines, Admirality Islands, Solomon Islands, Normanby Island, New Caledonia, Coasts of Queensland, Fiji, Samoa, Society Islands.

In sea, brackish, and fresh water.

17. **Siganus guttatus** (Bl.)

Chaetodon guttatus Bloch, Ausländ. Fische III, 1787, p. 55.

Amphacanthus concatenatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 127.

Amphacanthus lineatus Cuvier & Valenciennes, ibid. p. 130.

Amphacanthus guttatus Cuvier & Valenciennes, ibid. p. 136.

Amphacanthus firmamentum Cuvier & Valenciennes, ibid. p. 142.

?*Teuthis concatenata* Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1190.

Amphacanthus guttatus Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. Teuthieden, p. 10.

Amphacanthus labyrinthoides Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 471.

Amphacanthus concatenatus Bleeker, Acta Soc. Sc. Indo-Neerl. I, 1856. Beschr. vischs. Amboina, p. 46.

Teuthis concatenata Günther, Cat. Brit. Mus. III, 1861, p. 316. — Fische der Südsee I, 1873-1875, p. 88.

Amphacanthus guttatus Kner, Novara Exp. Fische I, 1865-1867, p. 208.

Teuthis concatenata Day, Fishes of India, Part I, 1875, p. 167.

Teuthis flava De Vis, Proc. Linn. Soc. New S. Wales IX, 1884, p. 462.

Siganus lineatus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 35.

Siganus lineatus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 271. — Mem. Carnegie Mus. IV, N° 4, 1909, p. 198.

Siganus aurolineatus Ogilby, Mem. Queensl. Mus. I, 1912, p. 56.

Amphacanthus concatenatus M. Weber, Siboga Exp. Fische 1913, p. 330.

Siganus lineatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 283.

Amphacanthus lineatus Whitley, Rec. Austr. Mus. XVI, N° 4, 1928, p. 231.

Teuthis concatenata Herre & Montalban, Philipp. Journ. Sc. XXXV, 1928, p. 231.

Teuthis lineata Herre & Montalban, ibid. p. 176.

Teuthis concatenata Tirant, Service Océan. Indochine. 6e. note, 1929, p. 15.

Siganus concatenatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 293.

Siganus lineatus Fowler & Bean, ibid. p. 319.

Teuthis concatenata P. Schmidt, Trans. Pac. Comm. Acad. Sc. USSR I, 1930, p. 105.

Siganus concatenatus Chevey, Trav. Inst. Océan. Indochine, 4e. Mém. 1932, p. 97.
Siganus lineatus Fowler, Mem. D. P. Bishop Mus. VI, N° 6, 1934, p. 429.
Teuthis lineata Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 257.

D. XVII. 10. A. VII. 9. P. 2.13-14. V. I. 3. I. Sq. l. 135-145.

Ltr. $\dfrac{18\text{-}20}{\dfrac{1}{85\text{-}100}}$.

Height 2-2.1, 2.5-2.6 in length with caudal. Head 3.2-3.8, 3.9-4.7 in length with caudal. Eye 2.8-3.5, 1.3-1.8 in snout, and 1.1-1.2 in somewhat convex interorbital space. Profile of head concave at nape, especially in young, convex from eye to upper lip. Cheeks scaly. First dorsal spine about three fourths of eye. Fourth to seventh or to ninth spines about of equal length, as long as snout or one third diameter of eye longer. Last spine about twice as long as the first. Soft dorsal angular, the second ray longest, equal to snout and half eye. First anal spine as long as eye, last spine longest, equal to snout or to snout and half eye. Soft anal similar to soft dorsal. Pectorals equal to snout and eye or somewhat shorter. Ventrals equal to snout or somewhat longer. Caudal slightly emarginate, almost truncate. Caudal peduncle about as long as deep, its least depth equal to eye, less than eye in young. Colour of preserved specimens brownish; sides of head, body, and tail silvery in young. Body and tail with numerous brown blotches, larger than the interspaces, which last form a more or less metallic bluish network. On the sides of a young specimen several blotches are confluent in a longitudinal line, and under certain light the fish appears silvery with bluish rings, forming chains and longitudinal parallel lines of the same colour. In life this specimen was silver with bronze blotches and with a yellow blotch behind the base of the dorsal. In the same specimen the sides of the head are silvery, with bluish lines, one from eye to corner of mouth, one from upperpart of hindborder of preopercle, obliquely down below eye to near corner of mouth, and a third, parallel to it, through lower part of preopercle. Another specimen is uniformly brown, the lines on the head dark brown. In a very large specimen of 330 mm these lines are also present as violet bands on a brownish ground colour. Interorbital space greyish black in a young specimen, still darker above eye. Spinous dorsal, spinous anal, and ventrals dark brown or greyish black; soft dorsal and anal with indications of dark longitudinal bands or rows of spots. Caudal with distinct rows of dark spots, the hindborder of the fin dusky in a young specimen. Pectorals yellowish. Length 384 mm.

Habitat: Singapore!; Sumatra (Benkulen, Trussan, Padang!, Oleleh!, Deli); Batu Islands; Bintang; Banka; Java (Jakarta!, Cheribon, Karangbollong, Surabaya); Madura!; Borneo (Balikpapan!, Sandakan); Celebes (Makassar!, Badjoa, Menado, Tanawanko); Limbe Strait; Dodepo and Pasejogo Islands; Saleyer!; Sangi Islands; Sulu Islands; Buru; Ceram; Obi; Ternate; Gomomo; Ambon!; Banda!; New Guinea. — Mozambique, Coasts of India, Andamans, Siam, Penang, Indochina, Japan?, Formosa, Riu Kiu Islands, Philippines, Pelew Islands, Carolines, Admirality Islands, New Britain, Nauru, Solomon Islands, Coasts of Queensland, Santa Cruz Islands, New Hebrides, New Caledonia, Fiji. In sea.

Note. Among my material there is a specimen of 330 mm, which perfectly agrees with the figure given by Bloch of his *Chaetodon guttatus,* the only difference being that Bloch's figure does not show the lines on the head, which are distinct in my specimen, and have the same course as those on young specimens of *concatenatus.* I am almost sure that Bloch's *guttatus* is a large specimen of *concatenatus.* It is worth noting that all descriptions of *guttatus* by later authors are based on large specimens. As *guttatus* is the oldest name, the species hitherto called *concatenatus* has to change its name into *guttatus.*

After what Herre & Montalban (l.c.) have said about the colour variation I do not doubt that *lineatus* is only a synonym of *guttatus. Amphacanthus firmamentum* has been described after a drawing. The caudal is emarginate, the snout short, the back dark blue, lighter below, with numerous orange brown blotches. Three lines, obliquely descending on cheeks. An oval green blotch at base of caudal. I have little doubt that this drawing represents a young specimen of *guttatus.* Fowler & Bean (Bull. U. S. Nat. Mus. 100, Vol. VIII, 1929, p. 313) also say that *firmamentum* may have been intended for *guttatus.*

5. Suborder **Acanthuroidea**

Oblong, compressed, covered with minute more or less shagreen like scales. Sides of head scaly. Lateral line complete. Two nostrils on each side of the snout. A more or less developed subocular shelf. Caudal peduncle on each side with one or more bony plates or spines. Mouth small, terminal, not or slightly protractile. Maxillary more or less firmly attached or ankylosed to the premaxillary. Teeth more or less compressed, often denticulated. Palate toothless. One dorsal, consisting of a spinous and a soft part, the latter generally much longer than the former. Anal with II or III spines and a soft portion, generally similar to that of the dorsal. Pectorals of moderate size. Ventrals with I spine and 3-5 rays. Origin of ventrals slightly behind that of pectorals. Gill membranes broadly attached to the isthmus. 22-23 vertebrae. Pseudobranchiae present. Young passing through a larval stage.

Note. The larval stages of the members of this suborder have formerly been considered as species and genera of their own. Bleeker (Nat. Tijdschr. Ned. Indië VI, 1854, p. 494, — ibid. IX, 1855, p. 305-306) first raised doubt against the validity of the genus *Keris*. Günther (Cat. Brit. Mus. III, 1861, p. 356) thought Bleeker's evidence doubtful, although he admitted that *Keris amboinensis* is a young *Naso*. Later (Ann. Mag. Nat. Hist. (4) VIII, 1871, p. 320) he came to the opinion, that the species of *Acronurus* and *Keris* do not belong to distinct genera but are larval forms of *Acanthurus* and *Naso*, and afterwards (Fische der Südsee I, 1873-1875, p. 108-p. 124) he discussed this matter more fully and gave descriptions and figures of several stages. Hilgendorf (Sitzber. Ges. naturf. Freunde 1883, N° 3, III), could add to the results, attained by Günther, and Lütken (Spolia Atlantica, 1880) gave still more instances and described a still younger stage, preceding that of *Acronurus*. M. Weber (Siboga Exp. Fische, 1913, p. 320, p. 322) mentions simlar pre-acronurus stages and also a probable pre-keris stage. Whitley & Colefax (Proc. Linn. Soc. New S. Wales LXIII, Parts 3-4, 1938, p. 295) gave a summary of the larval acanthuroid stages described, and a list of the literature consulted on the subject.

Our present knowledge of the development of the Acanthuroidea is still very incomplete. Eggs are unknown. The first larval stage of *Acanthurus* and *Naso*, and probably also of the other genera, is a pelagic larva with one of the anterior dorsal and anal spines greatly elongated, and more or less denticulated. The pectoral is normally developed, but the ventral is only represented by a long spine, which shows feeble denticulations. No spines or bucklers on the caudal peduncle are developed in this stage. The *Acronurus* stage, which is known to occur in *Acanthurus, Ctenochaetus,* and *Zebrasoma,* is characterized by the absence of scales, the skin having vertical striae. The spines at the caudal peduncle are developed, and the dentition is like that of the adult. The body, which is much compressed, is deeper than in the adult. Thorax and abdomen are generally of a silvery colour, and there is often a dark band on the nape.

Several forms described as species of *Acronurus* have not yet been identified, but for others, which show characteristic markings, this has been possible, for instance in the case of *A. triostegus,* and *lineatus.*

The larval form of *Naso* is the *Keris* stage. Here too the body is much compressed and deep, the vertical profile steeply descending in a curved line from chin to anus. The body is covered with scales, which are regularly arranged in almost vertical series, suggesting the vertical striae of the naked skin in *Acronurus.* In *Keris* there is no sign of the buckler or bucklers on the caudal peduncle. These develop gradually, first as differentiated patches, then as plates and only in semi-adult specimens the fixed spines or keels on the plates appear. The first dorsal and anal spines are relatively longer in the *Keris* stage than in the adult. There is therefore a gradual change from the *Keris* to the adult stage. Young *Keris* often show a similar silvery hue on thorax and belly, and a similar dark band on the nape as *Acronurus,* and also transverse bands or rows of spots which disappear again during further development.

1. Family ACANTHURIDAE

For characters of the single family see those of the suborder.

Distribution. Tropical and subtropical seas.

Key to the Indo-Australian genera of Acanthuridae.

1 Caudal peduncle with one erectile antrorse spine on each side, also developed in young. Three anal spines.
  a. Teeth movable, setiform, flattened near tip. 8-9 dorsal spines . . . . 1. *Ctenochaetus* p. 128.
  b. Teeth immovable, lobate, broad.
    a^1. Ventrals with 3 soft rays . . . . . . 2. *Paracanthurus* p. 131.
    b^1. Ventrals with 5 soft rays
      a^2. 7-9 dorsal spines. Teeth well developed . . . . 3. *Acanthurus* p. 133.
      b^2. 6-7 dorsal spines. Teeth small, inconspicuous . . . . 4. *Harpurina* p. 165.
      c^2. 3-5 dorsal spines. Body deep . . 5. *Zebrasoma* p. 167

2. Caudal peduncle with one or two immovable bony bucklers, each keeled or with a rigid spine, not developed in young. Two anal spines. Ventrals with 3 rays . . . . . . 6. *Naso* p. 171.

1. **Ctenochaetus** Gill

(Gill, Proc. U. S. Nat. Mus. VII (1884) 1885, p. 277, p. 279 1)).

Oblong, compressed, covered by small ctenoid scales. Mouth very small, terminal. Jaws equal. Teeth in the jaws in a single series, movable, setiform, slender and somewhat curved, expanded and flattened near the top and here serrulated along the outer edge, or along both sides in the *Acronurus* stage. Gillopenings restricted to the sides, the gillmembranes confluent and attached to the isthmus. An erectile antrorse spine on each side of the caudal peduncle, fitting in a groove. Origin of dorsal in a vertical between eye and gillopening, consisting of VIII or IX spines and 26-29 rays; anal with III spines and 25 rays, its origin below penultimate dorsal spine. Pectorals long, rather pointed. Ventrals pointed, with I spine and 5 rays. Caudal forked, the lobes falcate.

Distribution. One or two species (see below) from the tropical and subtropical parts of the Indic and Western Pacific.

1. **Ctenochaetus strigosus** (Benn.) (Fig. 24, p. 129)

Acanthurus strigosus Bennett, Zool. Journ. IV, 1828, p. 41.
Acanthurus ctenodon Cuvier & Valenciennes. Hist. Nat. Poissons X, 1835, p. 241.
Acanthurus strigosus Cuvier & Valenciennes, ibid. p. 243.
Acanthurus strigosus Bleeker, Nat. Tijdschr. Ned. Indië IV, 1852, p. 264. — ibid. VI, 1854, p. 102.
?*Acanthurus striatus* Günther, Cat. Brit. Mus. III, 1861, p. 334.
Acanthurus strigosus Günther, ibid. p. 342.
Acanthurus ctenodon Günther l.c.
Acanthurus ctenodon Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 156.
Acanthurus strigosus Kner, Novara Exp. Fische I. 1865-1867, p. 211.
Acanthurus ctenodon Playfair, Fishes of Zanzibar, 1866, p. 57.
Acanthurus ctenodon Day, Proc. Zool. Soc. London, 1870, p. 688.
Acanthurus (Ctenodon) ctenodon Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 509.
Acronurus lineolatus Klunzinger, ibid. p. 511.

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1) On p. 277, in the "Synopsis of Genera" *Ctenochaetus* is characterized as follows: "Teeth movable and setiform, but without dilated apices", but in the diagnosis on p. 279 this character is assigned by mistake to *Zebrasoma* and the teeth of *Ctenochaetus* are called "fixed and strong".

Acanthurus strigosus Günther, Fische der Südsee I, 1873-1875, p. 116.
Acanthurus strigosus Day, Fishes of India, Part II, 1876, p. 207. — Suppl. 1888, p. 789.
Acanthurus (Ctenodon) strigosus Klunzinger, Fische des rothen Meeres I, 1884, p. 85.
Ctenochaetus strigosus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 109.
Ctenochaetus strigosus Jenkins, Bull. U. S. Fish. Comm. XXII (1902) 1904, p. 480.
Ctenodon ctenodon Fowler, Journ. Acad. Sc. Philadelphia (2) XII, Part 4, 1904, p. 545.
Ctenochaetus striatus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 355.
Teuthis striatus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 780.
Ctenochaetus strigosus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 438.
Ctenochaetus strigosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 274.
Ctenochaetus strigosus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII. 1929, p. 200. — ibid. XI, N° 5, 1931, p. 344.
Acanthurus strigosus Hardenberg. De Tropische Natuur XXII, 1933, p. 155.
Ctenochaetus strigosus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 247.
Ctenochaetus strigosus Fowler, Mon. Acad. Nat. Sc. Philadelphia II, 1938, p. 76, p. 147, p. 185, p. 215, p. 233.

D. VIII-IX. 26-29. A. III. 25. P. 2. 14-15. V. I. 5. Ll. about 115. Ltr. $\dfrac{11\text{-}12}{\dfrac{1}{39\text{-}40}}$.

Height 1.9-2, 2.3-2.7 in length with caudal. Head 3.2-3.6, 4.4-5 in length with caudal. Eye 3.5-4.3, 2-3 in snout, and 1.1-1.4 in

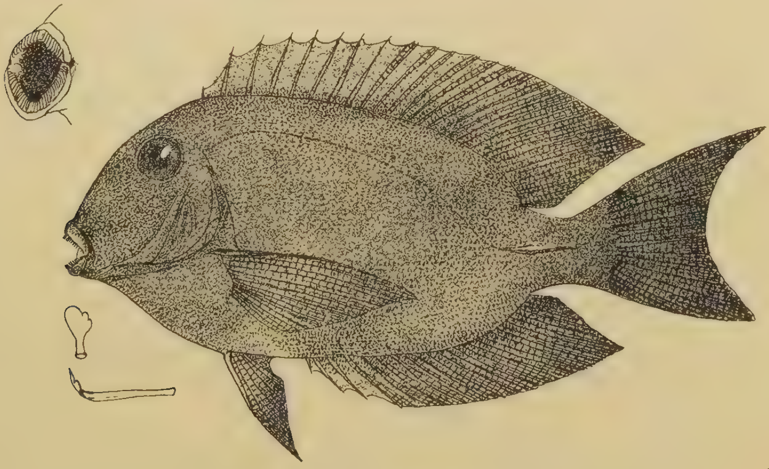

Fig. 24. *Ctenochaetus strigosus* (Benn.) × 5/6. above: opened mouth to show the teeth; below: teeth.

convex interorbital space. Origin of dorsal in a vertical between eye and gillopening. First dorsal spine about half length of second, which equals eye. Following spines and dorsal rays gradually increasing in height to about the 19th or 20th rays, which are as long as snout and half eye; the posterior rays rapidly decreasing in length, hence the fin is pointed. First anal spine very small, third longest, as long as longest dorsal spines. Soft anal similar to soft dorsal. Pectorals as long as head. Ventrals pointed, equal to snout and eye. Caudal forked, the lobes falcate, and somewhat produced in large specimens. Colour of preserved specimens deep reddish brown. Sides of body, and tail with many narrow longitudinal light bluish stripes. Fins dark as the body, dorsal with indications of longitudinal bands. Base of dorsal and anal posteriorly sometimes with a black blotch. Head and breast with light spots in life. Length 275 mm.

Habitat: Pulu Weh!; Sumatra (Kauer, Padang!, Priaman); Batu Islands; Java (Prigi, Karangbollong); Bali; Borneo; Celebes (Menado, Tanawanko, Basa Reef, Gulf of Boni, Cape Kait); Sadaa Island; Binang Unang Island; Sulu Islands; Sangi Islands; Binongka!; Halamahera; Gomomo Island; Batjan; Ternate; Nusa Laut!; Goram!; Solor; Flores; Timor; Tiur!; Kur! Misol; Aru Islands!; New Guinea. — Coast of Zululand, Madagascar, Zanzibar, Red Sea, South Arabia, Mauritius, Coast of India, Ceylon, Andamans, China, Japan, Philippines, Pelew Islands, eastwards to Hawaii, Paumotu Islands, and Marquesas Islands. In sea.

Note. Herre, who has repeatedly been in the occasion to observe this species alive, says that *Acanthurus striatus* Q. G. (Voyage Uranie & Physicienne, Zool. 1824, p. 373) which many authors consider as the young of *strigosus*, is a different species. Herre gives the characteristics of both species as follows:

Height 2.3-2.4, 9-11 longitudinal white stripes, no spots on sides of head . . . . *striatus*

Height 1.8-2, many narrow irregular longitudinal blue lines, small spots on sides of head. . . . . *strigosus*

I have not seen specimens from the Indo-Australian Archipelago which agree with *striatus*, as characterized above. The largest specimen Herre examined measured 60 mm.

Günther (1873-1875, l.c.) described and figured an *Acronurus* of *strigosus* from Vavau, which agrees with *striatus* Q. G. Lütken (Spolia Atlantica, 1880, p. 172) already expressed doubt about the determination of this *Acronurus* by Günther, as the coloration differs so much from half grown and adult specimens of *strigosus*. Herre says that specimens of *striatus* and *strigosus* of the same size are altogether different.

2. **Paracanthurus** Bleeker

(Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 252)

Colocopus Gill, Proc. U. S. Nat. Mus. VII (1884) 1885, p. 279.

Oblong, compressed, covered with thick granulated scales; those on the head larger than those of the body. The scales of the middle of the tail spinulous. Mouth very small, terminal. Jaws equal. A single series of flattened teeth in both jaws; those of the upper jaw lobate along their sides and along the cutting edge, those of the lower jaw only along the cutting edge, the lobes more elongate than those of the upper jaw. Gillopenings restricted to the sides, the gillmembranes confluent and attached to the isthmus. An erectile antrorse spine on each side of the caudal peduncle, fitting in a groove. Origin of dorsal in a vertical between eye and gillopenings. Dorsal consisting of IX spines and 19-20 rays. Anal with III spines and 18-20 rays, its origin below penultimate dorsal spine. Pectorals pointed. Ventrals with I spine and 3 rays, the first of lastnamed slender and close to the spine, the second and third rays coalesced in their basal half, attached to the belly by a membrane, and covered with thick scales, similar to those of the belly, and giving the rays the appearance of an inner spine as in the genus *Siganus*. When pressed against the body they cover the anal region, the only part of the skin not protected by scales. Caudal truncate, but the lobes projecting and pointed.

Distribution that of the single species known.

1. **Paracanthurus hepatus** (L., partim, C. V.). (Fig. 25, p. 132)

Teuthis hepatus Linné, Syst. Nat. ed. 12. I, 1766, p. 507 (partim).
Acanthurus hepatus Bloch Schneider, Syst. Ichth. 1802, p. 211 (partim).
Acanthurus theuthis Lacepède. Hist. Nat. Poissons IV, 1802, p. 547, p. 549.
Acanthurus hepatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 183.
Acanthurus hepatus Bleeker, Nat. Tijdschr. Ned. Indië VI, 1852, p. 325.
Acanthurus hepatus Günther, Cat. Brit. Mus. III, 1861, p. 341.
Paracanthurus hepatus Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 252.
Acanthurus hepatus Günther, Fische der Südsee I, 1873-1875, p. 115.

Acanthurus hepatus Day, Fishes of India, Part II, 1876, p. 206.
Colocopus lambdurus Gill, Proc. U. S. Nat. Mus. VII (1884) 1885, p. 279.
Colocopus lambdurus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 355.
Acanthurus teuthis M. Weber, Siboga Exp. Fische, 1913, p. 318.
Paracanthurus lambdurus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 435.
Paracanthurus theuthis Fowler, Mem. B. P. Bishop Mus. X, 1928. p. 273.
Paracanthurus theuthis Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 205.

D. IX. 19-20. A. III. 18-20. P. 2. 14-15. V. I. 3.

Height 2.2-2.5, 2.7-3 in length with caudal. Head 3.6-4, 4.5-4.8 in length with caudal. Eye 4.7-5.1, 3.2-3.7 in snout, and 1.4-1.5 in very convex interorbital space. First dorsal spine very small, second spine slightly shorter than third, which is half as long as snout and eye. Following spines subequal, the last one shorter. First dorsal ray as long as the longest spine, following rays gradually decreasing in length. First anal spine very small, second about two thirds of third spine, which equals longest dorsal spines in length. Soft anal similar to soft dorsal. Pectorals as long as the distance between the anterior end of their base and the end of the snout. Ventrals about three fourths of the snout. Caudal truncate when the fin is expanded, but the lobes produced and pointed. Colour of preserved specimens blue or bluish green. A dark brown band from eye, running upwards to dorsal and then along back to caudal peduncle, where it is much broadened. A forward branch along median line of body curves upwards above pectoral and joins here the dorsal band in adults, enclosing a large elliptical patch the colour of the body. In young ones this branch does not reach quite as far. Caudal

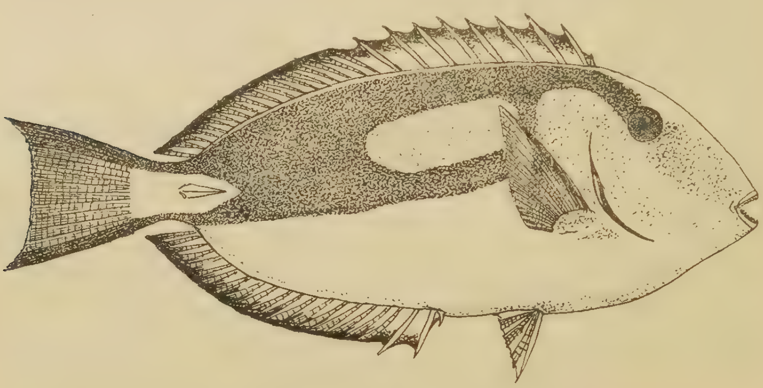

Fig. 25. *Paracanthurus hepatus* (L., partim, C. V.). × 1/2.

peduncle and caudal lobes dark; a triangle, the top of which is near the point of the spine on the caudal peduncle, and the base of which is formed by the truncate hindborder of the caudal, yellow. Dorsal and anal blue, the spines and rays, and the edges of the fins brown. Pectorals brown, their distal part light. Ventrals blue or brownish, the tips of the fin darker. Length 262 mm.

Habitat: Pulu Weh!; Sumatra (Priaman); Java (Jacarta); Celebes (Makassar, Menado!); Limbe Strait; Ceram; Tidore; Ambon; Flores; Banda!; Misol; New Guinea (Manokwari, Moresby Bay). — Mauritius, Coasts of India, Philippines, Pelew Islands, New Britain, Kingsmill Islands. In sea.

Note. Linné confused two species, an Atlantic and an Indic one, when describing his *Teuthis hepatus*. American authors use the name *hepatus* for the Atlantic species, but I don't think that this is in accordance with the International Rules of Nomenclature. Art. 31 says that the division of a species into two or more restricted species is subject to the same rules as the division of a genus, and about the division of genera Art. 30g. says that any subsequent author may select the type and that such designation is not subject to change. Cuvier & Valenciennes (l.c.) were the first to detect the duality of Linné's species and they selected *hepatus* as the name for the Indic species. According to the rules the Indian species has therefore to be called *hepatus*. Meek & Hoffman (Proc. Acad. Nat. Sc. Philadelphia 1884, p. 231), the first who introduced *hepatus* for the Atlantic species, argue that Gronovius's specimen, to which Linné referred amongst others, and which is still in the British Museum, is the American species. The fact remains, however, that Linné confused two species, described by Brown, Gronovius, Catesby, and Seba, the latter being undoubtedly the Indian species. Cuvier & Valenciennes who clearly point out that their specimen was of the same species as that figured by Seba, had therefore full right according to modern rules to bestow the name *hepatus* on the Indian species, and this designation cannot be changed by the later discovery, that Gronovius's species belonged to the American one.

3. **Acanthurus** Forskål

(Forskål, Descript. Animal. 1775, p. 59)

Rhombotides Klein, Neuer Schauplatz I, 1775, p. 922 (not binominal).
Hepatus Gronovius, Zoophylac. 1763, p. 113 (not binominal).
Teuthis Linné, Syst. Nat. Ed. 12. I, 1766, p. 507 (pro parte).
Acronurus Günther, Cat. Brit. Mus. III, 1861, p. 345.

Oblong or ovate, compressed, covered with rather thick, minute scales, which are ctenoid, but generally lanceolate, and more or less cycloid on anterior part of body. Mouth small, terminal. Jaws equal. A single series of flattened teeth in both jaws, lobate or denticulate along their cutting edge, and often also along the sides. Gillopenings restricted to the sides, the gillmembranes attached to isthmus. An erectile antrorse spine on each side of the caudal peduncle, fitting in a groove. Dorsal consisting of IX, rarely of VIII or VII spines, and 20-32 rays. Anal with III spines and 19-29 rays. Ventrals with I spine and 5 rays. Caudal truncate, emarginate, lunate, or forked, the lobes often produced and pointed.

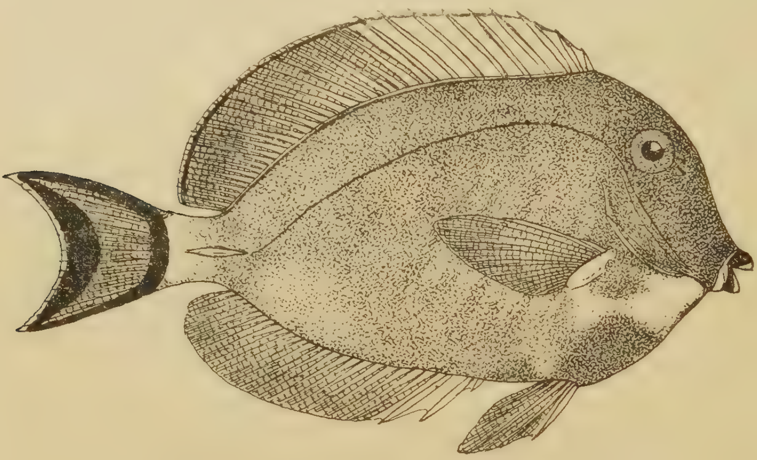

Fig. 26. *Acanthurus leucosternon* Benn. × $^5/_8$.

Distribution. Red Sea, tropical, and subtropical parts of Indic, Pacific, and Atlantic. Generally on or near coral reefs.

Key to the Indo-Australian species of Acanthurus

I. A light ring round the mouth or round the lower jaw.
  A. D. VII. 27-29 . . . . 1. *A. fuscus* p. 137.
  B. D. VIII-IX. 24-31.
    a. A white semilunar patch below eye. Dorsal with 29-30 rays . . . . . . 2. *A. glaucopareius* p. 138.
    b. Chest white. Caudal white, bordered by black on all sides. Dorsal with 28-29 rays . . . . 3. *A. leucosternon* p. 139.

c. A white band across breast. A white band across base of caudal. Dorsal with 24-25 rays . . . . 4. *A. leucocheilus* p. 140.

d. Opercle with a dark hindborder. D. VIII. 27 (28) . . . . 5. *A. celebicus* p. 141.

II. No light ring round the mouth.

A. Height 1.5-1.6. D. IX. 27 (28). A. III. (25). Posterior half of body, tail. dorsal, and anal spotted with white. . . . . 6. *A. guttatus* p. 142.

B. Height 1.7-2.4.

a. Dorsal with 28, anal with 20 rays. Brown, posterior half of pectorals yellowish . . . . 7. *A. doreensis* p. 144.

b. Dorsal with 22 (23), anal with 19-20 rays. Five narrow transverse dark bands on head and body. . . . . . 8. *A. triostegus* p. 144.

c. Dorsal with 24-29 rays. Anal with 23-27 rays. No transverse bands.

a^1. Light blue bands, broadly bordered by black, radiating from eye, and forming longitudinal bands on back. A similar vertical band at base of caudal.
Height 2-2.2 . . . . 9. *A. lineatus* p. 147.

b^1. No longitudinal bands or very narrow ones.

a^2. A light or dark marking on the shoulder.

a^3. Dorsal with 27-29 rays, anal with 25-27 rays . . 10. *A. fowleri* p. 149.

b^3. Dorsal with 24-26 rays, anal with 23-24 rays.

a^4. Shoulder mark dark, elongate. Generally a dark longitudinal band from caudal spine forwards. Head unspotted 11. *A. gahhm* p. 150.

b^4. Shoulder mark dark, elongate. Head spotted 12. *A. maculiceps* p. 152.

c^4. Shoulder mark dark, circular, smaller than eye. Profile of head strongly convex . . . 13. *A. bariene* p. 153.

d^4. Shoulder mark light, bordered by dark . . 14. *A. olivaceus* p. 154.

b^2. No distinct shoulder mark.

a^3. Profile of head convex. Uniform brown, with a broad pale interocular band, beginning behind each eye 15. *A. dussumieri* p. 155

b^3. No light interocular band.
  a^4. Head and body brown. Caudal peduncle may be light.
    a^5. Corner of mouth nearer to hindborder of preopercle than to eye.
      a^6. 8-9 rather slender teeth in each ramus of both jaws . . . . 16. *A. matoides* p. 156.
      b^6. 5-6 rather broad teeth in each ramus of both jaws. A dark blotch in axils of dorsal and anal . . . . 17. *A. lineolatus* p. 160.
    b^5. Corner of mouth equidistant from hindborder of preopercle and from eye.
      a^6. 10 teeth in each side of upper jaw. 14 teeth in each side of lower jaw. 23-24 dorsal rays. Dark, caudal light . . . . 18. *A. philippinus* p. 161.
      b^6. 8-9 teeth in each side of both jaws. 25-26 dorsal rays.
        a^7. Head and body with dark longitudinal lines 19. *A. bleekeri* p. 162.
        b^7. Head and body uniform . . . 20. *A. weberi* p. 163.
  b^4. Head, body, tail, and fins yellow. Corner of mouth nearer to hindborder of preopercle than to eye . . . . 21. *A. chrysosoma* p. 165.

1. **Acanthurus fuscus** Steind.

Acanthurus fuscus Steindachner, Verh. zool. bot. Ges. Wien XI, 1861, p. 176.
Acanthurus fuscus Günther, Cat. Brit. Mus. III, 1861, p. 339.
Acanthurus fuscus Duncker & Mohr, Mitt. Zool. Staatsinst. und Zool. Mus. Hamburg XLIV, 1929, p. 75.
Teuthis fuliginosus Whitley & Colefax, Proc. Linn. Soc. New S. Wales LXIII, 1938, p. 294 (nec Less.).

D. VII. 27-29. A. II-III. 26. P. 2. 13-15. V. I. 5.

Height 1.6-1.9. Head 3.3-3.6. Eye 3.5-4.4, about 3 in snout and 1.6 in interorbital space. Profile of head convex from dorsal to eye, concave on snout, the mouth slightly produced. Dorsal spines increasing in length to the last, which equals one third of the height. Soft dorsal and soft anal somewhat pointed in large specimens. Caudal emarginate, the lobes pointed and filamentous in large specimens. Colour dark brown. Lips encircled by white or chin only whitish. The caudal peduncle at base of caudal may be white. (Compiled, not seen by me).

Habitat: Ambon. — New Britain, Nauru. In sea.

Note. The synonymy given above is a tentative one, as I have not seen specimens of this species. *A. fuscus* certainly belongs to the group of *Acanthurus* with a more or less concave snout, more than 26 dorsal rays, and a white ring round the lips. Günther already suggested that it may be identical with *celebicus*. I should also have considered it as an abnormal specimen, with reduced number of dorsal rays of *celebicus* or of one of the other species of this group, but for the description given by Whitley & Colefax, l.c. of a fish, which they consider to be a variety of *fuliginosus*. Lastnamed species certainly belongs to this group too, but the formula of the dorsal is given as IX. 28, whereas the specimen of the Australian authors has seven spines, just as in *fuscus*. It is on account of this last characteristic that I unite provisionally *fuscus* and *fuliginosus* Whitley & Colefax.

It remains, however, possible, that both are abnormal specimens, as there seems to be a tendency in this group of *Acanthurus* to develop the last dorsal spines as rays. Bleeker for instance mentions specimens of *celebicus* with 8 and with 9 dorsal spines.

Otherwise the number of dorsal spines is constantly 9 in *Acanthurus,* with the exception of *nubilus* Fowler & Bean, which has 6 or 7 spines, and *pyroferus,* which has been described by Von Kittlitz as having 7 spines. *A. nubilus,* however, seems altogether to differ from the other species of *Acanthurus* by its inconspicuous teeth, and *pyroferus* is a problematic species, which has never been found again.

There are some minor differences between the specimen described by Steindachner and that described by Whitley & Colefax. The first is apparently a large specimen with produced caudal rays and pointed dorsal and anal. Steindachner also mentions a dark border to the opercle and preopercle, whereas Whitley and Colefax say that their specimen has milky spots on middle of sides of posterior part of body, and on dorsal and anal.

2. **Acanthurus glaucopareius** Cuv.

Acanthurus nigricans Bloch Schneider, Syst. Ichth. 1801, p. 211 (nec L.).
Acanthurus glauco-pareius Cuvier, Règne Animal, ed. 2. II, 1829, p. 224.
Acanthurus aliala Lesson, Voyage Coquille. Poissons, 1830, p. 150.
Acanthurus glaucopareius Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 190.
Acanthurus glaucopareius von Kittlitz, Mus. Senckenberg. 1834, I, Hft 3, p. 192.
Harpurus nigricans Lichtenstein, in Forster, Descr. Animal. 1844, p. 214.
Acanthurus glaucopareius Bleeker, Acta. Soc. Sc. Indo-Neerl. I, 1856. Beschr. nieuwe vischs. Amboina, p. 47.
Rhombotides glaucopareius Bleeker, Ned. Tijdschr. Dierk. I, 1865, p. 288.
Acanthurus glaucopareius Günther, Fische der Südsee I, 1873-1875. p. 114.
Teuthis aliala Jordan & Evermann, Fishes of North and Middle America II, 1898, p. 1693.
Teuthis aliala Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 109.
Hepatus aliala Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 350.
Acanthurus aliala Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 416.
Hepatus glaucopareius Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 272.
Hepatus glaucopareius Fowler & Bean. Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 246.
Acanthurus aliala Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 241
Teuthis glaucopareius Whitley & Colefax, Proc. Linn. Soc. New S. Wales LXIII, 1938, p. 297.
Hepatus glauco-pareius Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 103.
Acanthurus glaucopareius, L. P. Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 161.

D. IX. 29 (30). A. II. 30 (31). P. 2. 14. V. I. 5.

Height 1.7-1.8, 2-2.1 in length with caudal. Head 3.4-3.5, 4.1-4.2 in length with caudal. Eye 3.1-3.3, 2.5-2.6 in snout, and 1.2 in very convex interorbital space. Profile of head convex before eye, steeply down from there to snout. Corner of mouth much nearer to hindborder of preopercle than to eye. Teeth coarsely lobated. Last dorsal spine longest, almost twice diameter of eye. Soft dorsal and anal evenly rounded. Pectorals equal to snout and eye, ventrals as long as snout. Caudal emarginate. Colour of preserved specimens brown. A light band across lower jaw. A bluish elongate patch immediately below eye. Dorsal and anal light brown, with a narrow dark subterminal and a white terminal border; basal part of dorsal and anal posteriorly light, the colour tapering anteriorly into a narrow line, especially in the anal. Caudal with a broad grey hind-border, separated from the brown colour of the rest of the fin by a narow dark line. Pectorals yellowish hyaline, ventrals dark brown. Length 287 mm (Specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Ambon; Misol; New Guinea (Hood Bay). — Riu Kiu Islands 1), Philippines, Marianas, Carolines, Woodlark Island, Gilbert Islands, Phoenix Isalnd, Samoa, Society Islands, Paumotu Islands, Marquesas Islands, Hawaii, Cocos Islands, Socorro and Clarion Islands, off the W. Coast of Mexico. In sea, along reefs, feeding on algae.

3. **Acanthurus leucosternon** Benn. (Fig. 26, p. 134)

Acanthurus leucosternon Bennett, Proc. Zool. Soc. London 1832. p. 183.
Acanthurus Delisiani Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 193.
Acanthurus leucosternon Bleeker, Nat. Tijdschr. Ned. Indië XII, 1856-1857, p. 237.
Acanthurus leucosternon Günther, Cat. Brit. Mus. III, 1861, p. 340.
Acanthurus leucosternon Day, Fishes of India, Part II, 1876, p. 203.
Rhombotides leucosternon Bleeker, Recherches fauna Madagascar. Pollen & van Dam. 4e Partie. Poissons, 1878, p. 97.

D. IX. 28-29. A. III. 26-27 (28). P. 2. 13. V. I. 5. Ll. 192-209.

Ltr. $\frac{17}{1 \atop 93}$.

Height 1.8, 2.4 in length with caudal. Head 3.2-3.3, 4.1-4.3 in length with caudal. Eye 3.8-4, 2.9 in snout and 1.1-1.2 in very convex interorbital space. Teeth large, truncate and lobate, 4-5 in

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1) P. J. Schmidt (Trans. Pac. Comm. Ac. Sc. USSR, I, 1930, p. 102) described a specimen from the Riu Kiu Islands which differs from typical specimens by having a much larger light patch below the eye, reaching to the upper lip, and which he considers to be a northern subspecies, calling it *japonicus*.

each side of both upper and lower jaws. Nostrils close together, just before eye, both with a rim, which is produced posteriorly in a flap at the anterior nostril. Profile of head very steeply descending in an almost straight line from before eyes to mouth. Origin of dorsal slightly behind gillopening; first spine minute, second spine half length of snout, following ones gradually increasing in length to the last, which almost equals snout. Soft dorsal rounded, the median rays longest, but not much longer than last spine; posterior rays about two thirds of median ones. Origin of anal below last dorsal spine. First anal spine minute, the third longest, but less than the last dorsal spine. Soft anal similar to soft dorsal, but somewhat lower. Pectorals equal to snout and eye. Ventrals equal to snout. Caudal lunate. Colour of preserved specimens bluish grey; caudal peduncle lighter, more yellowish. Head very dark brown. Chest, and a ring encircling the lower parts of the mouth, white. A dark patch between upper end of gillopening and base of pectorals. Dorsal and anal yellowish, more reddish towards the base, and with a narrow white outer and a black inner edge. Caudal yellowish, a dark brown transverse band at its base and a crescentic one of the same colour, with a narrow white outer edge, at its end; both bands connected by upper and lower black edges to the fin. Length 165 mm.

Habitat: Pulu Weh!; Sumatra (Coast of Deli!) Batu Islands; Java (Jacarta). — Zanzibar, Mauritius, Ceylon. In sea.

Note. Fowler & Bean wrongly united this striking species, which seems to be confined to the Indic, with *celebicus*.

4. **Acanthurus leucocheilus** Herre

Acanthurus leucocheilus Herre, Philipp. Journ. Sc. XXIV, 1927, p. 419.
?*Acanthurus grammoptilus* Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 225.

D. IX. 24-25. A. III. 23.

Height 2-2.4. Head 3.3-3.7. Eye 3.6-3.9, 2.7 in snout and 1.1-1.3 in low convex interorbital space. The dorsal and anterior profile of head varies considerably; it may be a steeply convex uniform curve from dorsal to below eyes, then nearly vertical to upper lip, and lips and mouth projecting, or the snout may be very convex and humplike below eyes and above mouth. Nine or ten teeth with broad lobate tips on each side of upper jaw and 10 or 11 similar teeth on each side of lower jaw; dorsal and anal of approximately equal moderate height, angulate posteriorly, first dorsal spine very small, both first and second spines concealed by a covering of thick skin; the spines increasing in length to the ninth, which is 1.7-1.9 in head. The soft dorsal approximately equals the longest spine in height; first anal spine concealed, third 2.4 in head. Pectorals approximately equal to head. First ventral ray elongated, with threadlike tip, 1.1-1.2 in head. Caudal deeply lunate with long pointed tips. Colour of preserved specimens uniform blackish brown; snout just above and behind lips black; a broad bluish pearly or pearly white band encircles mouth, or may be only partially developed on upper lip; a similar wide band crosses breast from before anterior angle of gill opening to opposite side and joined by a band on each side to the ring about mouth; a broad bluish white band encircles base of caudal. Pectorals black with a bright yellow transverse bar on posterior margin, which later faded to white; dorsal, anal and ventrals black or brownish black; central part of caudal, back to posterior margin, black, or sometimes with a bluish white lunate band near posterior margin; caudal spine white, its groove with a narrow black margin. Length 200 mm. (After Herre, not seen by me).

Habitat: Borneo (Sandakan). — Philippines.

Note. Fowler & Bean consider *leucocheilus* as a synonym of *grammoptilus* Rich. Judging from the descriptions I doubt if they are the same and also if Fowler & Bean's specimens are identical with *grammoptilus*. Fowler & Bean do not mention the light chin band, which seems to characterize *leucocheilus* and they say: "It is in the pale hind border to the pectoral that the most striking and constant character is found, and this will distinguish the species most any time". A light border to the pectoral, however, occurs in several species of *Acanthurus,* also combined with a white band on caudal peduncle, as in *matoides,* and *gahhm.* Specially *matoides* seems to me to be very near the specimens described by Fowler & Bean.

5. **Acanthurus celebicus** Blkr.

Acanthurus celebicus Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 761.
Acanthurus celebicus Kner, Novara Exp. Fische I, 1865-1867, p. 211.
Rhombotides celebicus Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 235.
Acanthurus celebicus Günther, Fische der Südsee I, 1873-1875, p. 115.
Acanthurus celebicus Day, Fishes of India, Part II, 1876, p. 206.

Hepatus celebicus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 34.
Acanthurus celebicus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 417.
Hepatus leucosternon Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 243 (nec Bennett).

D. VIII. 27 (28). A. III. 24 (25). P. 2. 14. V. I. 5.

Height 1.9-2, 2.7-2.9 in length with caudal. Head 3.4-3.6, 4.9-5 in length with caudal. Eye 3.2-4.2, 2.4-3.2 in snout and 1.1-1.3 in convex interorbital space. Profile of head convex from dorsal to eye, that of snout concave, the mouth being somewhat produced. Teeth long and slender, somewhat stalked, the median ones lobated on the side and on top, the lateral ones only along their posterior border. There are about six teeth in each ramus of the upper jaw and of the lower jaw, and they are not placed vertically in the jaws as usual, but obliquely, the median ones of left and right sides forming an acute angle. Origin of dorsal above gill opening. First spine half diameter of eye, second about equal to eye, following spines gradually increasing in length to the last, which equals distance between corner of mouth and eye. Soft dorsal somewhat pointed behind, the longest ray as long as snout. Second anal spine longer than first, equal in length to sixth dorsal spine. Soft anal similar to soft dorsal. Ventrals with the first ray produced, about as long as pectorals, and as snout and eye. Caudal lunate, the lobes produced. Colour of preserved specimens brownish, mouth and chin almost black. A white ring encircling lower lip and inferior part of upper lip. Hindborder of opercle, and hind and lower border of preopercle, as well as a triangular area between gill opening and pectoral, black, Axil of pectoral also black. Caudal spine black. Fins very dark brown or black, distal half of pectorals and a narrow posterior edge of caudal white. A fresh specimen was bronze-coloured, and the posterior edges of the caudal orange. Length 250 mm.

Habitat: Java (Jacarta!); Danawan and Si Amil Islands; Celebes (Makassar, Badjoa, Kait Point in Libani Bay); Halmahera; Ternate; Makian; Ambon; Adonare!; New Guinea (Manokwari). — Coasts of India, Riu Kiu Islands, Philippines, Solomon Islands, New Caledonia, Society Islands, Hawaii.

6. **Acanthurus guttatus** Bl. Schn.

Acanthurus guttatus Bloch Schneider, Syst. Ichth. 1801, p. 215.
Acanthurus guttatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 195.
Harpurus guttatus Lichtenstein in Forster, Descr. Animal. 1844, p. 218.

Acanthurus guttatus Günther, Cat. Brit. Mus. III, 1861, p. 329. — Fische der Südsee I, 1873-1875, p. 109.
Rhombotides guttatus Bleeker, Recherches faune Madagascar, Pollen & van Dam, 4e Partie, Poissons, 1878, p. 96.
Zebrasoma guttatus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 110.
Teuthis guttatus Jenkins, Bull. U. S. Fish. Comm. XXII (1902) 1903, p. 479.
Hepatus guttatus Jordan & Evermann, ibid. XXIII (1903) 1905, p. 392.
Hepatus guttatus Jordan & Seale, ibid. XXV (1905) 1906, p. 354.
Acanthurus guttatus Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 66.
Hepatus guttatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 265.
Hepatus guttatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 248.
Hepatus guttatus Fowler, Mem. B. P. Bishop Mus. XI, N° 6, 1934, p. 427. — Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 126, p. 184.

D. IX. 27 (28). A. III. 24 (25). P. 2. 14. V. I. 5. Ll. about 130-150. Ltr. $\begin{array}{c}20\\ 1\\ \hline 56\text{-}65\end{array}$.

Upper profile from dorsal to tip of snout steeply ascending, slightly concave on snout, convex between the eyes. Height 1.5-1.6, 1.9-2 in length with caudal. Head 3.3-3.4, 4.2-4.5 in length with caudal. Eye 4.1-4.4, 3.4-3.5 in snout and 1.5-1.6 in moderately convex interorbital space. Teeth broad, deeply lobate, about 6-7 in each ramus of both upper and lower jaw. Nostrils close together, just before eye, the anterior with a low rim, which is posteriorly developed into a triangular flap. Origin of dorsal well behind gill opening. Dorsal high, evenly rounded, the first spine minute, the following spines and rays increasing in length to the third ray, which equals distance between eye and base of pectoral; following rays gradually decreasing in length again. Origin of anal below first dorsal ray. First anal spine small, second about two thirds of third, which is as long as fourth dorsal spine. Soft anal rounded, the fourth ray slightly longer than its neighbours, as long as longest dorsal ray. Pectorals triangular, as long as the distance between the posterior end of their base and the tip of the snout. Ventrals shorter than pectorals, as long as distance between posterior end of base of pectoral and corner of mouth. Caudal slightly emarginate. Colour of preserved specimens lighter or darker brown. Dorsal, anal, and body and tail between these fins, as well as caudal peduncle, covered with white spots, more or less elongate, and forming longitudinal rows on the sides. Anterior part of body and head without spots. A dark band or stripe behind gill opening. A broad light band, not always distinct, from below anterior part of dorsal to vent or to middle of anal. Thorax light. Caudal brown, darker in its distal half. Pectorals and ventrals lighter or darker brownish. Length 295 mm.

Habitat: Pulu Weh!; Pulu Babi!; New Guinea (Moresby Bay). — Mauritius, Réunion, Philippines, Pelew Islands, Marianas, Carolines, New Hebrides, New Caledonia, Kingsmill Islands, Ellice Islands, Samoa, Society Islands, Paumotu Islands, Hawaii.

7. **Acanthurus doreensis** C. V.

Acanthurus doreensis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 220.

Rhombotides doreensis Bleeker, Arch. Neerl. Sc. Nat. XIII, 1878, p. 51.

Acanthurus doreensis Macleay, Proc. Linn. Soc. New S. Wales VII, 1882, p. 354.

Hepatus doreensis Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 351.

D. IX. 28. A. III. 20. P. 15. V. I. 5.

Profile of head sigmoid. Anal and dorsal pointed, the anal more so than the dorsal. Caudal lobes pointed, and one third of the fin. Upper teeth crenulated on sides and tip, those of the lower jaw rounded and crenulated at the end only. Colour brown. Posterior half of pectoral yellowish. Caudal with a white terminal edge. Length 200 mm (After Cuvier & Valenciennes, not seen by me).

Nomen indig.: Vanaki (Moresby Bay).

Habitat: New Guinea (Manokwari, Moresby Bay).

Note. Besides Cuvier & Valenciennes, Macleay (l.c.) is the only one, who has recorded this species, but he gives no description. It is characterized by the great difference between the number of dorsal and anal rays, which is quite unusual in *Acanthurus* and merits confirmation.

8. **Acanthurus triostegus** (L.)

Chaetodon triostegus Linné, Syst. Nat. ed. 10. 1758, p. 274.

Acanthurus triostegus Bloch Schneider, Syst. Ichth. 1801, p. 215.

Acanthurus zebra Lacepède Hist. Nat. Poissons IV, 1802, p. 546, p. 548.

Chaetodon couage Lacepède, ibid. p. 726, p. 727.

Acanthurus hirudo Bennett, Fishes of Ceylon, 1828, N° 11.

Acanthurus triostegus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 197.

Harpurus fasciatus Lichtenstein, in Forster, Descr. Animal. 1844, p. 216.

Acanthurus pentazona Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. Kennis Teuthieden, p. 13.
Acanthurus triostegus Bleeker, l.c.
Acanthurus pentazona Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 107.
Acanthurus triostegus Montrouzier, Ann. Sc. phys. Soc. d'Agric. Lyon (2) VIII, 1856, p. 459.
Acanthurus triostegus Günther, Cat. Brit. Mus. III, 1861, p. 327.
Acanthurus pentazona Günther, ibid. p. 329.
Rhombotides triostegus Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 235.
Rhombotides pentazona Bleeker, ibid. II, 1865, p. 288.
Acanthurus triostegus Hutton, Fishes of New Zealand, 1872, p. 15.
Acanthurus triostegus Günther, Fische der Südsee I, 1873-1875, p. 108.
Acanthurus triostegus Day, Fishes of India, Part II, 1876, p. 204.
Acanthurus triostegus Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 161.
Acanthurus zebra De Vis, Proc. Linn. Soc. New S. Wales VIII (1883) 1884, p. 447.
Acanthurus triostegus Hilgendorf, Sitzber. Ges. naturf. Freunde 1883, N° 3, p. 44.
Acanthurus triostegus Waite, Proc. Linn. Soc. New S. Wales (2) IX, part 2, 1894, p. 217.
Teuthis triostegus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 108.
Teuthis triostegus Jordan & Evermann, Proc. U. S. Nat. Mus. XXV, 1902, p. 357.
Teuthis triostegus Jordan & Fowler, ibid. p. 552.
Hepatus triostegus Steindachner, Sitzber. Akad. Wien CXV, 1906, p. 1392.
Hepatus triostegus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 354.
Teuthis triostegus Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI, N° 7, 1911, p. 309.
Teuthis triostegus Kendall & Radcliffe, ibid. XXXV, N° 3, 1912, p. 144.
Acanthurus triostegus M. Weber, Siboga Exp. Fische, 1913, p. 316.
Hepatus triostegus Ogilby, Mem. Queensl. Mus. V, 1916, p. 184.
Teuthis triostegus McCulloch, Austral. Zoologist II, Part III, 1922, p. 108.
Teuthis triostegus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 778.
Acanthurus triostegus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 407.
Hepatus triostegus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 264.
Teuthis troughtoni Whitley, Rec. Austr. Mus. XVI, N°. 4, 1929, p. 233.
Hepatus triostegus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 249.
Hepatus triostegus Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 345. — ibid. N° 6, 1934, p. 426. — Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 480.
Acanthurus triostegus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 240.
Hepatus triostegus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 215, p. 173, p. 184.
Teuthis troughtoni Whitley & Colefax, Proc. Linn. Soc. New S. Wales LXIII, 1938, p. 294.
Teuthis triostegus Marshall, Mem. Queensland Mus. XII, Part I, 1941, p. 62.
Acanthurus triostegus L. P. Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 162.
Acanthurus triostegus triostegus L. P. Schultz & L. P. Woods, Journ. Washingt. Acad. Sc. XXXVIII N° 7, 1948, p. 249.

D. IX. 22 (23). A. III. 19-20. P. 2. 13. V. I. 5. Ll. about 150-160.

Ltr. $\dfrac{17\text{-}18}{\dfrac{1}{72\text{-}77}}$.

Height 1.8-1.9, 2.3 in length with caudal. Head 3.1-3.3, 3.7-3.9 in length with caudal. Profile of head somewhat convex before eyes, concave on snout, more so in older specimens than in young. Eye 3.7-3.9, 2.2-2.5 in snout, and 1.1-1.2 in convex interorbital space. Teeth deeply lobate, 6-8 in each ramus of both upper and lower jaw. Nostrils rather close together, just before eye, both with a low rim, which is posteriorly produced into a triangular flap in that of the anterior nostril. Origin of dorsal above gill opening. First dorsal spine about half diameter of eye, and one third of second. Following spines gradually increasing in length to the sixth to ninth spines, which are subequal, and equal to distance between hindborder of maxillary and eye. Soft dorsal as high as spinous part, rounded behind. First anal spine slightly shorter than first dorsal one, second spine three fourths of third, which equals longest dorsal spines. Soft anal less deep than dorsal, rounded behind. Pectorals triangular, as long as snout and eye. Ventrals as long as snout, or half diameter of eye shorter. Caudal truncate. Colour of preserved specimens brownish or reddish brown above, white below, the two colours sometimes sharply separated by a dark brown somewhat undulating stripe from chin to end of anal, more or less broken into spots posteriorly. A row of distant dark spots may be present above the anterior half of this stripe. Five transverse rather narrow dark bands, more or less tapering inferiorly; the first from nape through eye to chin, the second from origin of dorsal to axil of pectoral, which rarely is elongate, forming a short vertical bar, not reaching lower down than the base of the fin. In the subspecies *sandvicensis* Streets this band runs down to the thorax, as a continuation of the second band. The third band runs from middle of base of spinous dorsal to above vent, fourth from beginning of soft dorsal to that of soft anal, fifth from middle of base of soft dorsal to that of soft anal. A sixth band on caudal peduncle, but widely interrupted on the sides and inferiorly and hence consisting of a narrow dark saddle above and a black spot or blotch on inferior part of sides. A median dark band from interorbital space to tip of snout. Dorsal and anal with a wider or narrower dark subterminal band, and a very narrow white terminal one. Anal sometimes almost entirely dark. Caudal uniform greyish brown or darker distally with a white hindborder. Pectorals creamy hyaline. Ventrals more or less dusky terminally. Length 217 mm.

In the *Acronurus* stage, specimens of 26 and 27.5 mm, which have been described by Hilgendorf (l.c.) and Whitley & Colefax (l.c.), the transverse bands are already visible.

Nomen indig. Pidja (Javan.) Abila (Simalur), Bronangbronang (Malay).

Habitat: Pulu Weh!; Singapore; Simalur!; Nias!; Sumatra (Benkulen, Kauer, Trussan, Padang, Ulakan, Priaman, Coast of Deli!, Siboga); Java (Jacarta, Prigi, Patjitan, Karangbollong, Bay of Baron!, Batu Ulo!); Bawean; Strait of Madura; Celebes (Makassar, Badjoa, Tanawanko, Menado!); Sangir Islands; Talaut Islands!; Sulu Islands; Sula Islands!; Binongka!; Ceram; Batjan; Ternate; Ambon!; Goram; Nusa Laut!; Banda!; Sumba!; Flores!; Solor!; Pulu Babi; Rotti!; Timor!; Roma!; Tiur; Kei Islands; New Guinea (Manokwari, Moresby Bay). — Madagascar, Coast of Natal, Mozambique, Zanzibar, Seychelles, Mauritius, Réunion, Maldives, Coasts of India, Ceylon, Andamans, Cocos Keeling Islands, Formosa, Riu Kiu Islands, Japan, Philippines, Pelew Islands, Marianas, Markus Island, Marshall Islands, Carolines, Bismarck Archipelago, Solomon Islands, Santa Cruz Islands, New Hebrides, West and East Coast of Australia, New Zealand?, Ellice Islands, Rotuma, Fiji, Samoa, Society Islands, Cook Islands, Paumotu Islands, Marquesas Islands, Christmas Island, Palmyra, Hawaii.

Note. Specimens from the eastern parts of the Pacific (Revilla Gigedos, Islands off the coast of Mexico) belong to the subspecies *sandvicensis*, which does not occur in the Indo-Australian Archipelago. According to authors the separation of the two subspecies is not strictly geographical, as for instance the typical form occurs together with *sandvicensis* on Hawaii, although the latter is by far the commoner. This is a rare case of a species distributed from the East Coast of Africa to near the East Coast of America, and slightly modified in the most eastern part of its habitat. See also Schultz and Woods l.c.

9. **Acanthurus lineatus** (L.).

Chaetodon lineatus Linné, Syst. Nat. Ed. X. 1758, p. 274.
Acanthurus lineatus Bloch Schneider, Syst. Ichth. 1801, p. 214.
Acanthurus lineatus Lacepède, Hist. Nat. Poissons IV, 1802, p. 547, p. 550.

Acanthurus vittatus Bennett, Fishes of Ceylon, 1827, N° 2.
Harpurus lineatus Lichtenstein, in Forster, Descr. Animal. 1844, p. 216.
Acanthurus lineatus Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 263.
Acanthurus lineatus Günther, Cat. Brit. Mus. III, 1861, p. 333.
Rhombotides lineatus Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 235.
Acanthurus lineatus Kner, Novara Exp. Fische I, 1865-1867, p. 210.
Acanthurus lineatus Günther, Fische der Südsee I, 1873-1875, p. 111.
Acanthurus lineatus Day, Fishes of India, Part II, 1876, p. 203.
Teuthis lineatus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 108.
Hepatus lineatus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 351.
Hepatus lineatus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 270.
Acanthurus lineatus M. Weber, Siboga Exp. Fische, 1913, p. 317.
Acanthurus lineatus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 420.
Hepatus lineatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 269. — ibid. XI. N° 5, 1931, p. 345. — ibid. XI. N° 6, 1934, p. 427.
Hepatus lineatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p 217.
Hepatus lineatus P. Schmidt, Bull. Acad. Sc. URSS, 1930, p. 555.
Acanthurus lineatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 242.
Hepatus lineatus Fowler, Mem. Ac. Nat. Sc. Philadelphia II, 1938, p. 147, p. 202.

D. IX. 25-26. A. III. 26-27. P. 2. 14-15. V. I. 5. Ll. about 110. Ltr. $\frac{8}{\frac{1}{30}}$.

Height 2-2.2, 2.6-2.9 in length with caudal. Head 3.6-3.7, 4.8-4.9 in length with caudal. Eye 3.9-4.2, 2.8-2.9 in snout and 1.3-1.4 in very convex interorbital space. Teeth large, truncate and lobate, 6 or 7 in each branch of both upper and lower jaw. Nostrils close together, both with a rim, which is produced posteriorly in a flap at the anterior nostril. Profile of head descending in a steep curve from between eyes to mouth. Origin of dorsal above gill opening, the membrane of this fin very thick. First spine small, more or less hidden in the skin, second spine about two thirds of third, following spines subequal, the last more than half snout, and as long as first ray. Dorsal rays increasing in length to about the 20th, which is as long as snout, the posterior rays rapidly decreasing in length, the fin hence pointed behind. Origin of anal below last dorsal spine; the first spine hidden in the skin, the second about three fourths of the third, which is longest, and as long as longest dorsal spines. Soft anal similar to soft dorsal. Pectorals equal to head, ventrals much pointed, longer than pectorals. Caudal lunate, the lobes much pointed and produced. Colour of preserved specimens light bluish or violet. A variable number of light blue bands, broadly bordered by blackish, radiate from the eye and form parallel longitudinal bands on the back, which are more or less obliquely directed upwards and are continued on the dorsal. Similar bands below them on the sides, the most inferior one running from the lower base of the pectorals to the lower base of the caudal, separated from this fin by a vertical similar band, which encircles the caudal peduncle at base of caudal. This band variously connected with the longitudinal bands or not. Head with similar bands, radiating from eye, descending on cheeks and snout and variously bent backwards above mouth. Chin, throat, and belly uniform. Anal also uniform, with a dark edge, sometimes with an indication of a band, similar to those of the dorsal, in its posterior part. Base of dorsal and caudal lobes dark, rest of caudal lighter, this colour sometimes separated from the dark basal part by a narrow white line. Edge of the fin sometimes narrowly black. Basal half of pectorals with more or less distinct bands, similar to those of the body; distal part of the fin hyaline. Ventrals creamy, the spine and first ray black. Length 290 mm. In the *Acronurus* stage, at least in specimens of 30-37 mm, the longitudinal bands on the body are visible. There is a broad blackish band from nape through eye.

Habitat: Pulu Weh!; Sumatra (Kauer, Trussan, Padang, Ulakan); Nias!; Java (Patjitan, Karangbollong); Celebes (Menado, Tombariri); Sulu Islands; Talaut Islands; Sula Islands!; Ternate; Batjan; Ambon; Ceram!; Binongka!; Nusa Laut!; Rotti!; Timor; Tiur!; Aru Islands!; Waigeu; New Guinea (Humboldt Bay!, Moresby Bay). — Zanzibar, Coasts of India, Ceylon, Andamans, Riu Kiu Islands, Philippines, Marianas, Solomon Islands, Woodlark Islands, Santa Cruz Islands, Nauru, New Hebrides, Rotuma, Samoa, Society Islands, Christmas Island. In sea.

10. **Acanthurus fowleri** nomen novum.

Hepatus pyroferus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 232. (nec Kittlitz).

D. IX. 27-29 (30). A. III. 25-27 (28).

Height $1^7/_8$-$2^1/_8$. Head $3^1/_4$-$3^2/_5$. Snout $1^1/_4$-$1^1/_3$. Eye $4^3/_4$-$5^7/_8$, $3^2/_5$-$4^1/_3$ in snout, $1^2/_3$-$1^7/_8$ in interorbital space. Teeth 18-20 in jaws, moderate. Maxillary $4^1/_8$-$4^2/_3$ in head. Last dorsal spine $1^4/_5$-$2^1/_8$ in head, nineteenth ray $1^1/_3$-$1^2/_3$. Third anal spine $2^1/_2$-$2^3/_5$, nineteenth ray $1^1/_4$-$1^2/_3$. Caudal deeply emarginate or lunate, end produced in long points with age. Least depth of caudal peduncle $2^2/_3$-$2^3/_4$ in head. Pectoral 1-$1^1/_{10}$, ventral $1^1/_6$-$1^1/_3$. Body largely uniform chocolate brown. Usually large triangular darker area at humeral region, often only as angular and usually enclosing an area twice of extent of eye, sometimes rarely less than eye. Edge of opercular membrane along gill opening often dusky narrowly. Dorsal and anal largely dusky brown, deeper than body, each sometimes show narrow pale blue-gray basal line and edges of fins brighter blue narrowly. Caudal largely dusky medially and behind, base whitish or pale gray and upper and lower edges of fins brownish. Pectoral dusky or brownish largely, terminating above with broad pale blotch, light brown. Ventrals neutral dusky. Groove and edges of caudal spine blackish. Length 393 mm. (After Fowler & Bean, not seen by me).

Habitat: Buka Island; Maitara; Gomomo Island. — Philippines.

Note. I do not think that the species described above is the same as *Acanthurus pyroferus* Kittlitz (Mus. Senckenb. I, 1834, p. 193), which has seven dorsal spines and a very concave profile of the snout, the mouth being produced. *Acanthurus tennenti* Gthr (Cat. Brit. Mus. III, 1861, p. 337) which the authors quote among the synonyms, differs by having 23 dorsal rays (25 according to Day). Hence I have given it a new name.

11. **Acanthurus gahhm** (Forsk.)

?*Chaetodon nigricans* Linné, Syst. Nat. Ed. 10, 1758, p. 274.
Chaetodon gahhm Forskål, Descr. Animal. 1775, p. 64.
Acanthurus gahm Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 219.
Acanthurus gahhm Bleeker, Acta Soc. Sc. Indo-Neerl. III, 1858, Tiende Bijdr. vischf. Celebes, p. 8.
Rhombotides gahhm Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 288.
Acanthurus gahm Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 506.
Acanthurus gahm Günther, Fische der Südsee I, 1873-1875, p. 113.
Acanthurus (Rhombotides) gahm Klunzinger, Fische des rothen Meeres I, 1884, p. 84 (partim).
Acanthurus gahm Sauvage, Poissons de Madagascar, 1891, p. 338.
Acanthurus gahm Steindachner, Abh. Senckenb. naturf. Ges. XXV, 1901, p. 426.
Hepatus nigricans Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 351.
Acanthurus gahm Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 411.
Hepatus nigricans Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 233.

Acanthurus gahm var. *nigricauda* Duncker & Mohr, Mitt. Zool. Mus. Hamburg XLIV, 1929, p. 75.
Acanthurus gahm Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 241.

D. IX. 26. A. III. 23. P. 2. 15. Ll. 143-147. Ltr. $\begin{array}{c}13\text{-}14\\ \hline 1\\ \hline 65\text{-}80\end{array}$.

Height 2.1, 2.7-3 in length with caudal. Head 3.5-3.8, 4.6-5.4 in length with caudal. Eye 3.9-4.2, 2.9-3.2 in snout and 1.2-1.4 in convex or very convex interorbital space. Profile of head evenly convex from dorsal to tip of snout, much convex in large specimens. Corner of mouth nearer to hindborder of preopercle than to eye. Teeth rather slender, strongly lobated along the truncate tip and in smaller specimens also along the sides. Eight teeth in each ramus of both upper and lower jaw. Nostrils close together, near eye, with a low rim, that of the anterior nostril produced into a posterior flap. Origin of dorsal somewhat before or behind upperpart of gill opening. A rather thick sheath covered with small elongate scales along the base of the fin. First dorsal spine very small, second twice as long as first, following gradually increasing in length to the last, which is much less than distance between corner of mouth and eye, and about 1.5 in snout. The anterior spines stronger than the posterior ones. Soft dorsal slightly higher than spinous part, rounded behind in young, pointed in adults. First anal spine minute, third longest, about equal to fifth dorsal spine. Soft anal similar to soft dorsal. Pectorals as long as or slightly longer than head. Ventrals pointed, much so in adults, slightly shorter than pectorals. Caudal lunate, the lobes produced and curved. Colour of preserved specimens lighter or darker brown. A dark brown bar or elongate patch from upper extremity of gill opening to above middle of pectoral. Caudal spine in a dark brown area, which is produced forward as a tapering band, reaching to above posterior or even anterior part of anal. Posterior part of caudal peduncle and base of caudal abruptly white, rest of caudal brown, with a broad white hindmargin and a dark subterminal one. Pectorals of the colour of the body basally, then dark and then white at its distal third. Ventrals and anal of the colour of the body, the anal with a narrow dark edge. Length 343 mm.

Habitat: Pulu Weh!; Sulu Islands; Celebes (Makassar!, Badjoa, Kait Ponit, Limbe Strait); Saleyer!; Ternate; Ambon; New Guinea (Moresby Bay). — Madagascar, Zanzibar, Mauritius, Red Sea, Coasts of India, Formosa, Philippines, Admirality Islands, Solomon Islands, New Caledonia, Gilbert Islands, Fiji, Samoa, Society Islands, Paumotu Islands, Hawaii. In sea.

Note. *Chaetodon nigricans* has been described by Linné as a dark fish with a lighter caudal, occurring in the Red Sea. This may as well be *matoides* or *gahhm,* which live in that sea. No mention is made of the dark postocular bar, which characterizes *gahhm.* It is true that Forskål in describing this species, does not mention that band either. Cuvier & Valenciennes were the first to point out this feature and as the species so characterized has generally been called *gahhm* (or *gahm*) I have kept this name. Klunzinger thought that *matoides* and *gahhm* are the same species, but although they are closely related I find a difference in the number of scales in the linea lateralis and linea transversalis. The profile of the head is also much more convex in *gahhm,* and the caudal seems to have constantly a white edge in this species.

12. **Acanthurus maculiceps** (Ahl)

Hepatus maculiceps Ahl, Mitt. Zool. Mus. Berlin XI. 1. Heft, 1923, p. 36.
Hepatus maculiceps Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 240.

D. IX. 24-26. A. III. 23-24.

Height 1.75-2. Head 3.2-3.3. Eye 3.5-5, 3.2-3.75 in snout, and 1.3-1.8 in interorbital space. Profile of head convex. Corner of mouth much nearer to hindborder of preopercle than to eye. Teeth crenulated along their whole border, each ramus of the upper jaw with 8, and of the lower jaw with 9 teeth. Dorsal spines increasing in length to the last, which is 1.8-2 in head. Dorsal and anal rounded behind. Pectorals slightly shorter than head, ventrals 1.4 in head. Caudal deeply emarginate or lunate, the lobes elongated and pointed. Colour of preserved specimens chocolate brown. Trunk and tail with exceedingly fine, slightly waved longitudinal parallel lines. Head marked with light rounded spots, less than pupil. Behind the upper border of the opercle a black elongate blotch. A pale band behind chin. Fins blackish. Dorsal and anal with indistinct longitudinal bands. Caudal often with a pale transverse basal band and with a very narrow white terminal edge. Terminal third of pectorals yellowish. Length 352 mm. (Compiled, not seen by me).

Habitat: Birabirahan Island; Binang Unang Island; Kait Point, Libani Bay; Maitara. — Philippines, New Britain. In sea.

13. **Acanthurus bariene** Less.

Acanthurus bariene Lesson, Voyage Coquille, Zool. I, 1830, p. 150.
Acanthurus nummifer Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 234.
Rhombotides nummifer Bleeker, Versl. Akad. Amsterdam (2) II, (1867) 1868, p. 297.
Acanthurus bariene Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 409.
Hepatus bariene Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 222 (pro parte).

D. IX. 26. A. III. 24.

Height 1.9-2. Head 3.5-3.9. Eye 3.8-4.5, 2.9-3.9 in snout, and 3-3.8 in convex interorbital space. Profile of head strongly convex, with age the snout may become protuberant and overhang the mouth. Corner of mouth twice nearer hindborder of preopercle than eye. Ten teeth on each side of upper jaw, 11 in lower jaw. The very short first dorsal spine entirely concealed in thick skin, and all the spines slender and comparatively weak, the last one 1.4-1.7 in head. Dorsal rays equal to or a fifth higher than the spines, posterior angle of fin pointed. Anal resembles dorsal, third spine 2-2.2 in head, anal rays as long as last dorsal spine, posterior angle with an elongate sharp tip. Pectorals and ventrals a little more or less than head. Caudal deeply lunate with very long attenuate pointed tips. Colour of preserved specimens uniformly dark brown to blackish brown, posterior half darkest, with very fine blue longitudinal lines, or the region above pectorals may be more or less suffused with yellowish; above upper end of gill opening and directly behind eye is a circular violet black spot, smaller than eye, and fading in the smaller specimens. Vertical fins darker than body, or dorsal may be more or less yellow; below base of dorsal is a violet black band, broadest anteriorly and tapering back to a line which disappears about halfway to caudal; above it is a light blue line running the whole length of the base. There are three longitudinal blackish violet lines along margin of dorsal, the outer one broadest. The anal had a basal and a marginal violet or blue longitudinal line. Caudal shows traces of a pale basal ring; upper and lower margins of caudal brown, the lobes more or less barred or spotted, the central portion darker. Pectorals blackish, with a lemon yellow transverse bar near outer extremity, the bar prone to disappear in alcohol. Ventrals blackish violet. Length 432 mm. (After Herre, not seen by me).

Habitat: Waigeu. — Philippines. In sea, on rocky reefs.

Note. Fowler & Bean united *bariene* and *dussumieri*. I have seen neither, but from the account given by Herre it seems to me that they are different.

14. **Acanthurus olivaceus** Bl. Schn.

Acanthurus olivaceus Bloch Schneider, Syst. Ichth. 1801, p. 214.
Acanthurus eparai Lesson, Voyage Coquille, Zool. II, 1re Partie, 1830, p. 147.
Acanthurus olivaceus Kittlitz, Mus. Senckenb. 1834, I, Heft 3, p. 189.
Acanthurus humeralis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 169.
Acanthurus humeralis Eydoux & Souleyet, Voyage Bonite, Zool. I, 2. Partie, 1841, p. 169.
Harpurus paroticus Forster Lichtenstein, Descr. Animal. 1844, p. 183.
Acanthurus humeralis Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 762.
Acanthurus olivaceus Günther, Cat. Brit. Mus. III, 1861, p. 336.
Rhombotides olivaceus Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 288.
Acanthurus olivaceus Günther, Fische der Südsee I, 1873-1875, p. 113.
Acanthurus olivaceus Sauvage, Poissons de Madagascar 1891, p. 343.
Teuthis olivaceus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 107.
Teuthis olivaceus Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 476.
Hepatus olivaceus Jordan & Evermann, ibid. XXIII (1903) 1905, p. 385.
Hepatus olivaceus Jordan & Seale, ibid. XXV (1905) 1906, p. 350.
Hepatus olivaceus Jordan & Richardson, ibid. XXVII (1907) 1908, p. 270. — Mem. Carnegie Mus. IV, N° 4, 1909, p. 198.
Hepatus olivaceus McCulloch, Mem. Queensl. Mus. VII, Part IV, 1922, p. 243.
Acanthurus olivaceus Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 65.
Acanthurus olivaceus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 413.
Hepatus olivaceus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 271.
Hepatus olivaceus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 231.
Teuthis olivaceus McCulloch, Checklist Fish. Austr. Part II, 1929, p. 273.
Hepatus olivaceus P. Schmidt, Bull. Acad. Sc. URSS, 1930, p. 556.
Hepatus olivaceus Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 345. — Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 232.

D. IX. 24-25. A. III. 23 (24). P. 2.14-15. V. I. 5. Ll. about 180-200. Ltr. $\begin{array}{c} 15+8 \\ \hline 1 \\ \hline 88 \end{array}$.

Height 2.2-2.4, 2.9-3.4 in length with caudal. Head 3.7, 4.9-5.3 in length with caudal. Eye 3.8-4.3, 2.8-3.3 in snout, and 1.2-1.4 in very convex interorbital space. Profile of head convex from dorsal to tip of snout, that of snout almost straight or markedly convex. Corner of mouth almost twice as near to hindborder of preopercle than to eye. Nostrils close together, before eye, the anterior one with a more or less distinct posterior flap. 8-11 lobate teeth in each ramus of both jaws. Origin of dorsal slightly before upper extremity of gill opening. First dorsal spine half length of second, which is two thirds of third one. Following spines slightly increasing in length to the last, which is as long as distance between corner of mouth and eye or shorter in large specimens. First to fourth dorsal rays slightly longer than last spine, the following rays slightly, the five posterior rays rapidly, decreasing in length; the fin pointed or obtusely pointed behind. Pectorals as long as snout and eye or slightly shorter. Ventrals pointed, half diameter of eye shorter than pectorals. Caudal truncate, but the upper and lower lobes much produced, falcate. Colour of preserved specimens lighter or darker brown. A creamy band, red in life, bordered by black, from superior end of opercle backwards in a horizontal direction about as broad as eye, and shorter or longer than pectorals. Fins dark brown as the body, pectorals with a broad creamy terminal band; median caudal rays also creamy white in their distal two thirds, with a narrow dark outer border, the lobes uniformly dark brown. Length 337 mm.

Habitat: Celebes (Makassar!; Menado); Sulu Islands; Ambon; Goram; Banda!; Solor!; Aru Islands!; New Guinea (Humboldt Bay, Moresby Bay). — Mauritius, Riu Kiu Islands, Formosa, Philippines, Coast of Queensland, Pelew Islands, Marianas, Carolines, Kingsmill Islands, Rotuma, Samoa, Society Islands, Paumotu Islands, Hawaii. In sea.

15. **Acanthurus dussumieri** C. V.

Acanthurus dussumieri Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 201.

Acanthurus dussumieri Günther, Fische der Südsee I, 1873-1875, p. 112.

Rhombotides Dussumieri Bleeker, in Pollen & van Dam, Recherches sur la faune de Madagascar, 4e. Partie, Poissons, 1878, p. 96.

Acanthurus dussumieri Sauvage, Poissons de Madagascar, 1891, p. 337.

Acanthurus dussumieri Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 493.

Teuthis dussumieri Jordan & Evermann, Proc. U. S. Nat. Mus. XXV, 1902, p. 357.

Teuthis dussumieri Jordan, ibid. XXVI, 1902, p. 695.

Teuthis dussumieri Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 477.

Hepatus dussumieri Jordan & Evermann, ibid. XXIII (1903) 1905, p. 390.

Acanthurus dussumieri Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 65.

Acanthurus dussumieri Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 425.

Hepatus bariene Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 222 (pro parte).

D. IX. 24-25. A. III. 24.

Height 1.9-2.4. Head 3.7-4. Eye 3.7-4.6, 2-3.1 in snout, and 1.2 in convex interorbital space. Profile of head convex, much so in large specimens. Corner of mouth twice nearer hindborder of preopercle than to eye. 8-12 teeth in each ramus of both jaws. Circular anterior nostril with a thin membraneous margin becoming a flap posteriorly; posterior nostril much smaller. First dorsal spine very short and concealed in thick skin, the others increasing in length to the last, which is 1.7-1.9 in head. Soft dorsal of nearly uniform height, the longest rays 1.5-1.6 in head, the last rays shortened and the fin angulate posteriorly. Third anal spine 2.3-2.5 in head. Soft anal like soft dorsal in shape, the longest rays about 1.75 in head. Pectorals equal to or a little longer than head. Ventrals pointed, extending upon anal, about 1.4 in head. Caudal lunate, with acute tips. Colour of preserved specimens uniform brown, with a broad pale interocular band beginning behind each eye, and numerous dark brown longitudinal lines on nape, snout, sides of head, and breast; often these lines disappear after a time; the dorsal and anal may each have 3 or 4 longitudinal blue stripes and a basal band of the same colour. Pectorals dark anteriorly, with a yellow or clear transverse bar on posterior margin. In fresh specimens the central part of the caudal is dark dull blue with numerous darker or blackish spots. Length 408 mm. (Compiled, not seen by me).

Habitat: New Guinea (Moresby Bay). — Mauritius, Japan, Riu Kiu Islands, Formosa, Philippines, Samoa, Society Islands, Hawaii. In sea.

16. **Acanthurus matoides** C. V.

Acanthurus gahhm Rüppell, Atlas Reise N. Afrika. Fische, 1828, p. 58 (nec Forsk.).

Acanthurus matoides Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 204.

Acanthurus annularis Cuvier & Valenciennes, ibid. p. 209.

Acanthurus Blochi Cuvier & Valenciennes, l.c.

Acanthurus xanthopterus Cuvier & Valenciennes, ibid. p. 215.

Acanthurus Lamarri Cuvier & Valenciennes, ibid. p. 236.

Acanthurus matoides? Bleeker, Verh. Bat. Gen. XXIII, 1850. Bijdr. kennis Teuthiden, p. 12.

Acanthurus xanthopterus Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1191.

Acanthurus nigricans Bleeker, Versl. Akad. Amsterdam XIV, 1862, p. 108 (nec L.).

Rhombotides matoides Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 235.

Acanthurus matoides Kner, Novara Exp. Fische I, 1865-1867, p. 210.

Acanthurus matoides Playfair, Fishes of Zanzibar, 1866, p. 56. — Proc. Zool. Soc. London 1867, p. 858.

Acanthurus matoides Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 508.

Acanthurus blochii Günther, Fische der Südsee I, 1873-1875, p. 109.

Acanthurus matoides Day, Fishes of India, Part II, 1876, p. 205.

Acanthurus matoides Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 162.

Acanthurus annularis Macleay, l.c.

Acanthurus matoides Steindachner & Döderlein, Denkschr. Akad. Wien XLVIII, 1884, p. 37.

Acanthurus matoides Sauvage, Poissons de Madagascar, 1891, p. 340.

Acanthurus blochii Waite, Mem. Austr. Mus. III, 1899, p. 188.

Teuthis güntheri Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 477.

Hepatus matoides Jordan & Evermann, ibid. XXIII (1903) 1905, p. 387.

Hepatus guntheri Jordan & Evermann, ibid. p. 388.

Hepatus xanthopterus Jordan & Evermann, ibid. 389.

Hepatus matoides Jordan & Seale, ibid. XXV (1905) 1906, p. 352.

Hepatus matoides Evermann & Seale, Proc. U. S. Nat. Mus. XXXI, 1906, p. 509.

Hepatus matoides Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 34.

Hepatus matoides Jordan & Snyder, ibid. p. 217.

Hepatus matoides Jordan & Starks, Proc. U. S. Nat. Mus. XXXII, 1907, p. 502.

Hepatus matoides Seale, Philipp. Journ. Sc. V, N° 4, 1910, p. 283.

Teuthis guentheri Bamber, Journ. Linn. Soc. Zool. XXXI, 1915, p. 482.

Hepatus matoides Fowler & Bean, Proc. U. S. Nat. Mus. LXII, Art. 2, 1922, p. 57.

Acanthurus matoides Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 65.

Acanthurus matoides Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 567.

Acanthurus matoides Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 430.

Hepatus fuliginosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 266 (nec Lac.).

Hepatus fuliginosus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 211 (nec Lac.).

?*Hepatus nigrofuscus* Fowler & Bean, ibid. p. 237 (partim?, nec Forsk.?).

Hepatus fuliginosus P. Schmidt, Bull. Acad. Sc. URSS, 1930, p. 556.

Acanthurus fuliginosus Giltay, Mem. Mus. Roy. Hist. Nat. V, 1933, p. 86 (nec Lac.).

Hepatus fuliginosus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 102, p. 202, p. 230 (nec Lac.).

D. IX. 25-26. A. III. 23-25. P. 2. 15. V. I. 5. Ll. about 170-210.

Ltr. $\frac{\frac{16\text{-}20}{1}}{60\text{-}80}$.

Height 1.7-2, 2.3-2.7 in length with caudal. Head 3-3.8, 4-4.5 in length with caudal. Eye 3.2-4.7, 1.9-3.6 in snout, and 1-1.8 in convex interorbital space. Profile of head convex before eye, straight or slightly convex from eye to tip of snout. Corner of mouth nearer to hindborder of preopercle than to eye. Teeth slender, strongly lobate along their sides and on tip, which is scarcely truncated, each tooth slightly tapering towards its end. 8-9 teeth in each ramus of both jaws. Nostrils close together before eye, both with a rim which is produced posteriorly into a triangular flap. Origin of dorsal above upper extremity of gill opening. A rather thick sheath, covered with small elongate scales, along the whole base of the fin. First dorsal spine small, following increasing in length posteriorly to the fifth, the sixth to ninth subequal. The anterior spines rather strong and thick, the posterior ones slender, the last one equal to distance between eye and corner of mouth or somewhat longer or shorter. Soft dorsal slightly higher than spinous part, rounded behind, the last 8 rays rapidly decreasing in length. First anal spine very small, third longest about as long as sixth dorsal spine. Soft anal similar to soft dorsal. Pectorals as long as head. Ventrals pointed, shorter than pectorals, about as long as snout and half diameter of eye. Caudal truncate in young, with the lobes slightly produced; in adults the lobes are pointed, falcate, and the hindborder of the fin is lunate. Colour of preserved specimens brown or dark brown, sometimes with a dark violet tinge. Rarely indications of light wavy lines on sides and belly. Eyes and nostrils sometimes in a pale area. In young and semi adults the basal part of the caudal and the posterior part of the caudal peduncle are abruptly creamy, this colour spreading more or less on the caudal lobes. Traces of this light band may be present in adults, but generally the caudal is dark brown all over. Dorsal and anal dark brown or more or less violet, the soft portion of the fins with longitudinal light bands, as broad as the interspaces. Pectorals dark brown in their basal half, hyaline or white in their distal half. Ventrals dark brown. Length 610 mm. Specimens of 30 mm are still in the *Acronurus* stage, those of 38 mm have scales. According to Günther (l.c. 1873-1875) *Acanthurus melanurus* C. V. (Hist. Nat. Poissons X, 1835, p. 240), also described by Bleeker (Nat. Tijdschr. Ned. Indië III, 1852, p. 271), belongs to this species, although the specimens described by Cuvier & Valenciennes had a length of more than 50 mm.

Habitat: Pulu Weh!; Sumatra (Telokbetong, Benkulen, Ulakan, near Diamant Point!, Siboga); Java (Jacarta, Karangbollong, Patjitan, Tjilatjap!, Prigi); Bawean; Borneo (Balikpapan!, Sandakan, Sarawak); Bali; Celebes (Makassar!, Badjoa, Menado, Tanawanko, Tombariri) Sangir Islands; Sulu Islands; Ternate; Batjan; Buru; Ceram; Ambon!; Goram; Flores!; Rotti!; Timor; Kei Islands!; Aru Islands; Waigeu; New Guinea (Kaimana!, Moresby Bay). — Madagascar, East Coast of Africa south to Natal, Seychelles, Zanzibar, Red Sea, Coasts of Arabia and of India, Andamans, Cocos Keeling Islands, Pinang, Japan, Riu Kiu Islands, China, Philippines, Pelew Islands, Carolines, Admirality Islands, Coasts of North Australia, Kingsmill Islands, Funafuti, Fiji, Samoa, Society Islands, Paumotu Islands, Christmas Island, Fanning Island, Hawaii. In sea.

Note. I have united as *matoides* those specimens of dark coloured *Acanthurus* which have numerous slender teeth, a straight or slightly convex profile of the head, generally longitudinal bands on the dorsal and anal, and a light band through end of caudal peduncle and base of caudal in young. The distal half of the pectorals is generally light, more distinct so in old than in young. Fowler and others have united this species with *Acanthurus fuliginosus* Lesson (Voyage Coquille, Zool. II, 1re Partie, 1830, p. 149) but this species has the profile of the head concave, no bands on the fin, and the body striated transversally with red. This species, the type of which was caught at Oualan, does not belong to *matoides* but is related to the *celebicus* group.

Günther (l.c. 1873-1875) says that *matoides* and *blochi* are different on the authority of Sauvage, who gave him information about these species, but later Sauvage (l.c. 1891) united the two again.

A specimen in the collections of the Zoological Museum of Amsterdam, long 230 mm, shows very faint longitudinal lines on body and still fainter oblique ones on head. It is very much like the figure of the type of *A. atramentatus* as given by Jordan & Evermann (Bull. U. S. Fish Comm. XXIII (1903) Part I, 1905, fig. 171, p. 393), with the exception of the pectoral, which is distinctly and abruptly white in its distal part in my specimen. *A. atrimentatus,* however, is described as having a dark spot at the axil of dorsal and anal, features which are lacking in my specimen, which otherwise is exactly like normal *matoides* of the same length.

The fish described by Rüppell l.c. as *gahhm* is not the species of Forskål, but *matoides.* The dorsal and anal are described as striped, and no mention is made of the dark band behind eye.

Hepatus nigrofuscus Fowler & Bean (l.c.) may partly be *matoides*, partly *gahhm*. I have seen specimens from the Indo-Australian Archipelago which agree with their description of *nigrofuscus* in being brown, with the base of the caudal light, and no perceptible bands on dorsal and anal, but otherwise agreeing with *matoides*. I have not seen specimens with a dusky postocular blotch, which seems to be the mean characteristic of the species, but which is only developed in large specimens, according to Fowler & Bean.

17. **Acanthurus lineolatus** C. V.

Acanthurus lineolatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 207.
Acanthurus lineolatus Bleeker, Nat. Tijdschr. Ned. Indië VI, 1854, p. 101.
Rhombotides lineolatus Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 288.
Acanthurus lineolatus Günther, Fische der Südsee I, 1873-1875, p. 112.
Acanthurus lineolatus Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 493.
Hepatus atramentatus Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, p. 393.
Acanthurus nigroris M. Weber, Siboga Exp. Fische, 1913, p. 317.
Acanthurus atramentatus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 422.
Hepatus lineolatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 270.
Hepatus lineolatus Fowler & Bean, Bull. Nat. Mus. 100. Vol. VIII, 1929, p. 228.
Hepatus lineolatus Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 345. — Occas. Papers B. P. Bishop Mus. IX, 18, 1932, p. 11. — Monogr. Ac. Nat. Sc. Phildalphia II, 1938, p. 232.
Teuthis lineolatus Fowler, Proc. Acad. Nat. Sc. Philadelphia XCIII, 1941, p. 257.
Acanthurus elongatus Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 165 (nec Lac.?).

D. IX. 25-26. A. III. 25. P. 2. 14. V. I. 5. Ll. about 150. Ltr. $\begin{array}{c} 11+4 \\ \hline 1 \\ \hline 44 \end{array}$.

Height 2, 2.5-2.7 in length with caudal. Head 3.3, 4.2-4.5 in length with caudal. Eye 3.3, 2 in snout, and 1-1.1 in somewhat convex interorbital space. Profile of head convex from snout to dorsal, snout slightly concave. Corner of mouth much nearer to hindborder of preopercle than to eye. 5-6 rather broad strongly lobate teeth in each ramus of both jaws. Nostrils close together before eye, the anterior one with a posterior flap. Dorsal above upper extremity of gill opening. First dorsal spine less than one half of second, which is about two thirds of third. Following spines gradually increasing in length to the last, which equals the distance between corner of mouth and eye. Soft dorsal rays slightly increasing in length to the 20th, following rays rapidly decreasing in length, the fin somewhat pointed behind. First anal spine as long as first dorsal one, third spine longest, somewhat shorter than last dorsal spine. Soft anal similar in shape to soft dorsal, but less deep. Pectorals equal in length to the distance between the inferior end of their base and the tip of the snout. Ventrals somewhat shorter. Caudal lunate, the lobes pointed. Colour of preserved specimens brown, with or without indications of wavy light blue longitudinal lines, formed by light spots, one spot on each scale. Lips dark. A dark patch at chin, sometimes extending to inferior extremity of gill opening. Dorsal and anal darker than body, at least in their distal half. A dark patch in axils of both fins. Caudal brown, with a narrow posterior white edge, sometimes the upper and lower rays are also white. A more or less distinct dark subterminal transverse band may be present. Caudal spine generally in a black area. Ventrals generally dark brown. Pectorals light, the upper ray sometimes dark. Length 273 mm.

Habitat: Sumatra (North Coast of Atjeh!) Talaut Islands!; Binongka!; Obi; Ambon; Banda; Tiur!; Rotti. — Madagascar, Mauritius, Formosa, Philippines, Marcus Island, Samoa, Society Islands, Laysan, Hawaii. In sea.

Note. The specimens described above are those named *nigroris* by M. Weber l.c. As some of them show light blue lines, I place them under *lineolatus,* as *nigroris* is described as being uniform. It is, however, possible, that *nigroris* and *lineolatus* are the same species. Both have a black patch in the axils of dorsal and anal and agree in the form and number of teeth in the jaws.

18. **Acanthurus philippinus** Herre

Acanthurus philippinus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 434.
Hepatus philippinus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 215.

D. IX. 23-24. A. III. 23-24.

Height 2.16-2.2, head 3.5-3.85. Anterior dorsal profile boldly convex, forming smooth curve from dorsal to mouth, or the region above eyes nearly straight and a bulge before eyes. Ventral profile uniformly and strongly curved from mouth to caudal peduncle. Eye 3.5-3.7, 1.6-1.8 in snout. Interorbital space rather low, 2.85-3 in head. Teeth slender, with narrow pointed, finely serrate tips, 10 on each side in upper jaw and 12-14 on each side in lower jaw. Nostrils small, inconspicuous, the anterior one with a small posterior flap of skin, the posterior one partly concealed by skin. First dorsal spine very low, embedded in thick skin, the last spine twice, down to 1.8 in head. Dorsal rays equal to or usually a little higher than last spine, the posterior rays round pointed. Third anal spine 2.2-2.6 in head. Anal rays equal to dorsal, posterior rays a little higher, forming an elongate, acutely pointed angle. Caudal deeply lunate, tips elongate. Pectorals longer than head, 3.15-3.4 in length. Ventrals short, broad, 5-5.2. Colour in alcohol dark purplish brown, the vertical fins blackish or deep chocolate. Caudal pale brownish yellow. Pectorals and ventrals black or deep brown. Length 220 mm (After Herre, not seen by me).

Habitat: Danawan Island and Si Amil Island; Talisse Island; Basa Reef, Gulf of Boni; Buka Buka Island; Una Una Road, Gulf of Tomini; Cape Kait, Libani Bay, Celebes; Doworra Island; Maitara; Tidore. — Philippines. In sea.

Note. Three small specimens 32-55 mm collected by the Siboga Expedition at St. 125, Siau, and labelled by Max Weber with a query as *blochii* (Siboga Exp. Fische, 1913, p. 316-317), and a still smaller specimen from Ambon in the collection of the Amsterdam Museum may belong to this species. They are brown, caudal yellow, but there are only 8 teeth in each ramus of both jaws and there are 25 dorsal rays.

19. **Acanthurus bleekeri** Gthr.

Acanthurus mota? Bleeker, Nat. Tijdschr. Ned. Indië VII, 1854, p. 432.
Acanthurus bleekeri Günther, Cat. Brit. Mus. III, 1861, p. 335.
Acanthurus Bleekeri Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 156.
Rhombotides Bleekeri Bleeker, ibid. p. 270.
Acanthurus Bleekeri Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 509. — Fische des Rothen Meeres I, 1884, p. 85.
Acanthurus aurolineatus Day, Fishes of India, Part II, 1876, p. 204.
Harpurus gnophodes Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII, Part 4, 1904, p. 544.
Acanthurus nigroris W. Weber, Siboga Exp. Fische, 1913, p. 317 (pro parte).
Acanthurus bleekeri Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 423.
Hepatus bleekeri Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 220.

D. IX. 25-26. A. III. 24-25. P. 1. 15. V. I. 5. Ll. about 200. Ltr. $\frac{18}{\overline{1}\ \ \frac{}{70}}$

Height 2-2.1, 2.6-2.7 in length with caudal. Head 3.4-4.2, 4.5-5.3 in length with caudal. Eye 3.2-3.9, 1.7-2.3 in snout, and 1.2-1.5 in convex interorbital space. Profile of head regularly convex from snout to dorsal. Corner of mouth equidistant from hindborder of preopercle and from eye. Teeth in jaws rounded, slightly tapering to their base, lobate. About 8-9 teeth in each ramus of both jaws. Nostrils close together before eye, the anterior one much larger than the posterior and with a posterior flap. Origin of dorsal slightly in advance of upper extremity of gill opening. First dorsal spine one third of second, which is more than one half of head. Following spines gradually increasing in length to the last, which equals snout and half eye. First dorsal ray slightly longer than last spine, rays gradually but slightly increasing in length to about the fifth, which equals snout and eye, then slightly decreasing in length again, but the nine last rays rapidly decreasing in length, the fin being obtusely pointed. First anal spine equal to first dorsal one in length, third spine longest, as long as snout. Soft anal similar in shape to soft dorsal but less deep. Pectorals equal to or somewhat longer than head. Ventrals as long as snout and eye. Caudal emarginate or truncate, the lobes produced and pointed in adults. Colour of preserved specimens brown or dark bluish brown, with numerous longitudinal lines on head, body, and tail. These lines not always distinct. Fins brown or bluish brown, pectorals whitish distally. A very small dark blotch in the axil of the dorsal may be present in young specimens. Length 369 mm.

Habitat: Pulu Weh!; Sumatra (Padang); Java; Bali; Celebes (Makassar!, Badjoa, Menado); Limbe Strait; Karkaralong Islands!; Sulu Islands; Halmahera; Batjan; Makian; Buru; Ceram; Ambon; Timor. — Red Sea, Coasts of India, Paumotu Islands. In sea.

20. **Acanthurus weberi** (Ahl).

Acanthurus nigro-fuscus Günther, Cat. Brit. Mus. III, 1861, p. 331 (nec Forsk.?).
Rhombotides nigro-fuscus Bleeker, Ned. Tijdschr. Dierk. I, 1865, p. 288 (nec Forsk.?).
Acanthurus nigro-fuscus Perugia, Ann. Mus. Civ. Genova (2) VII, 1889, p. 273 (nec Forsk.?).
Acanthurus Güntheri M. Weber, Siboga Exp. Fische, 1913, p. 317 (nec Jenkins).
Hepatus weberi Ahl, Mitt. Zool. Mus. Berlin XI, 1. Heft, 1923, p. 37.
?*Hepatus nigrofuscus* Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 237.

D. IX. 25-26. A. III. 23-25. P. 2.15-16. V. I. 5. Ll. 130-150. Ltr. $\begin{array}{c}13+5\\ \hline 1\\ \hline 72\end{array}$.

Height 1.8-2, 2.3-2.4 in length with caudal. Head 3.2-3.4, 4-4.3 in length with caudal. Eye 3-3.3, 1.6-1.7 in snout, and 1-1.1 in moderately convex interorbital space. Profile of head slightly convex, almost straight. Corner of mouth equidistant from hindborder of preopercle and from eye. Eight to nine lobate teeth in each ramus of both jaws. Nostrils close together before eye, the anterior one larger than the posterior and provided with a more or less distinct posterior flap. Origin of dorsal slightly in advance of upper extremity of gill opening. First dorsal spine about one half length of second, which is about one half of third. Following spines gradually increasing in length to the last, which equals snout and half diameter of eye. Dorsal rays slightly increasing in length to about the 19th, which is somewhat longer than last dorsal spine. Following rays rapidly decreasing in length, the fin pointed behind. First anal spine as long as first dorsal one, third longest, equal to snout. Soft anal similar to soft dorsal. Pectorals as long as head. Ventrals slightly less than snout and eye. Caudal emarginate. Colour of preserved specimens brown. Dorsal, and anal darker, with or without light narrow longitudinal bands. Caudal brown, finely edged with white behind. Ventrals dark brown. Pectorals greyish hyaline. Length 124 mm.

Habitat: Sumatra?; Nias; Celebes (Menado); Sangi Islands; Ambon! — Ceylon. In sea.

Note. This description is made after the specimens from the Siboga Expedition, recorded by Max Weber. Most probably they are of the same species as those described by Günther as *nigro-fuscus*. As Weber remarked, it is very uncertain if *nigro-fuscus* Forskål is the same species. Weber therefore proposed the new name *Güntheri*, which has been changed into *Weberi* by *Ahl*, as *Güntheri* is preoccupied. Besides the specimens from the Siboga Expedition I have examined a specimen in the Amsterdam Museum from the Western Part of the Indo-Australian Archipelago, probably from Padang, Sumatra, or from Pulu Weh, and which agrees in all respects with the Siboga specimens.

This species is hardly different from *bleekeri*, the only difference being the longitudinal bands on head and body in lastnamed species, but as these bands are apt to fade in preserved specimens it is often difficult to distinguish between the two species.

21. **Acanthurus chrysosoma** Blkr.

Acanthurus chrysosoma Bleeker, Nat. Tijdschr. Ned. Indië XIII, 1857, p. 67.
?*Rhombotides xanthosoma* Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 288 (errore?).

D. IX. 24 (25). A. III. 24 (25). P. 2. 14. V. I. 5.

Height 2.3, 3.1 in length with caudal. Head 3.9, 4.4 in length with caudal. Eye 3.3, twice in snout, and about equal to interorbital space. Profile of head convex before eye, straight from eye to tip of snout. Corner of mouth nearer to hindborder of preopercle than to eye. Teeth lobate, in the specimen examined several teeth are wanting, but there are about 7 in one ramus of the lower jaw. First dorsal spine small, last spine slightly longer than the others, equal to snout. Second anal spine longest, as long as sixth dorsal spine. Soft dorsal and anal similar, angular or somewhat rounded behind. Pectorals equal to snout and eye, ventrals somewhat shorter. Caudal slightly emarginate. Colour of preserved specimen uniform brownish grey, fins yellow, reddish at base. According to Bleeker the colour when fresh is orange yellow, edges of dorsal, anal, and caudal slightly brownish (Description made after a specimen of 110 mm length from Bleeker's collection in the Leiden Museum. Bleeker's typical specimens were 43-51 mm).

Habitat: Bali; Buru; Ambon?; New Guinea (Fr. Wilhelm-Hafen). — Samoa. In sea.

Note. The name *Rhombotides xanthosoma* occurs only in a list of fishes from Ambon, where *Acanthurus xanthosoma* Blkr. is cited as a synonym. No description is given, and the species does not occur in the catalogue of the sale of Bleeker's collection after his death. Most probably *xanthosoma* is a lapsus calami for *chrysosoma*.

4. **Harpurina** Fowler & Bean

(Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 253).

Ovate, compressed, covered with large(?), compact, closely imbricated scales. Mouth small. Teeth small, crenulate, inconspicuous. An erectile antrorse spine on each side of the caudal peduncle, fitting in a sheath. Dorsal with VI or VII spines and 27 (28) rays. Anal with III spines and 23-24 (25) rays. Ventrals with one spine and 5 rays. Caudal deeply emarginate.

Distribution that of the single species known.

Note. Fowler and Bean described *Harpurina* as a subgenus of *Acanthurus*, but the reduced number of dorsal spines, combined with the small inconspicuous teeth are characteristics which justify its separation as a genus of its own. The authors describe the scales as being large, but I suppose they mean to say that the scales are larger than in *Acanthurus*.

1. **Harpurina nubilus** (Fowler & Bean) (Fig. 27, p. 166)

Hepatus nubilus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 253.

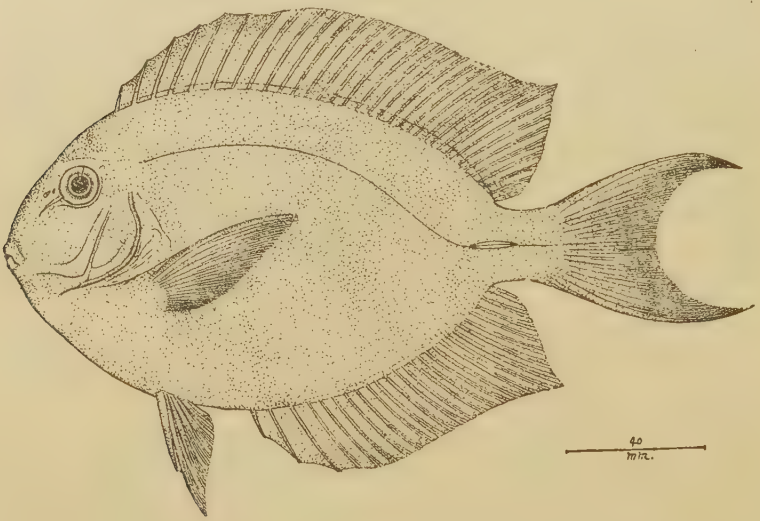

Fig. 27. *Harpurina nubilus* (Fowler & Bean). After Fowler & Bean.

D. VI-VII. 27 (28). A. III. 23-24 (25).

Height $1^{4}/_{5}$-$1^{7}/_{8}$. Head 4-$4^{1}/_{5}$. Eye 3-$3^{1}/_{3}$, $1^{7}/_{8}$-2 in snout, and $1^{1}/_{5}$-$1^{2}/_{5}$ in interorbital space. Front profile of body evenly lunate. 20-22 teeth in the jaws. Last dorsal spine $1^{2}/_{5}$-$1^{4}/_{5}$ in head, eighteenth ray $3^{4}/_{5}$-$4^{2}/_{3}$ in combined head and body. Third anal spine $1^{2}/_{3}$-$1^{7}/_{8}$ in head, sixteenth ray 1-$1^{1}/_{8}$. Pectorals $3^{1}/_{4}$-$3^{1}/_{3}$ in combined head and body. Ventrals $3^{3}/_{4}$-4. Largely dull dark brown with dusky over vertical fins and ventrals, pectorals with more brownish tinge. Length 243 mm. (After Fowler & Bean, not seen by me).

Habitat: Buka Buka Island and Dodepo Island, Gulf of Tomini, Celebes.

5. **Zebrasoma** Swainson

(Swainson, Nat. Hist. Anim. I, 1839, p. 256)

Ovate, compressed, covered with minute scales, which may partly be bristle-like. Snout more or less produced. Mouth small. Jaws equal. A single series of flattened lobate teeth in the jaws. Gill openings restricted to the sides, the gill membranes attached to isthmus. An erectile antrorse spine on each side of the caudal peduncle, fitting in a groove. Dorsal high or very high, consisting of III-V flexible spines, and 23-32 soft rays. Anal with III spines and 20-26 rays. Ventrals with one spine and 5 rays. Caudal truncate or slightly rounded.

Distribution. A few species from the tropical and subtropical parts of Indic and Pacific.

Key to the Indo-Australian species of Zebrasoma

1. D. III-IV. 31-32. A. III. 24-26 . . . . 1. *Z. veliferum p.* 167.
2. D. V. 24. A. III. 19 . . . . 2. *Z. flavescens* p. 170.

1. **Zebrasoma veliferum** (Bl.) (Fig. 28, p. 169)

Acanthurus velifer Bloch, Naturgesch. Ausländ. Fische IX, 1795, p. 106.
Acanthurus velifer Rüppell, Atlas Reise Nordl. Afrika, Fische, 1828, p. 58.
Acanthurus ruppelii Bennett, Proc. Zool. Soc. London, Part III, 1835, p. 207.
Acanthurus blochii Bennett, l.c.
Acanthurus velifer Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 251.
Acanthurus hypselopterus Bleeker, Nat. Tijdschr. Ned. Indië VI, 1854, p. 327.
Acanthurus kipas Bleeker, l.c.
Acanthurus velifer Bleeker, ibid. VII, 1854, p. 42. — ibid. VIII, 1855, p. 315.
Acanthurus Rüppellii Bleeker, ibid. VIII, 1855, p. 316.
Harpurus Rüppelli Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 235.
Harpurus hypselopterus Bleeker, ibid. p. 252.
Acanthurus velifer Günther, Cat Brit. Mus. III, 1861, p. 344.
Acanthurus rüppelli Günther, ibid. p. 345.
Acanthurus velifer Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 505.
Acanthurus hypselopterus Günther, Fische der Südsee I, 1873-1875, p. 117.

Acanthurus velifer Day, Fishes of India, Part II, 1876, p. 207.
Acanthurus (Harpurus) velifer Klunzinger, Fische des Rothen Meeres I, 1884, p. 85.
Acanthurus velifer Sauvage, Poissons de Madagascar, 1891, p. 344.
Acanthurus (Harpurus) hypselopterus Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 494.
Zebrasoma hypselopterum Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 479.
Zebrasoma veliferum Jordan & Evermann, ibid. XXIII (1903) 1905, p. 396.
Zebrasoma veliferum Jordan & Seale, ibid. XXV (1905) 1906, p. 356.
Zebrasoma rüppellii Bamber, Journ. Linn. Soc. London. Zool. XXXI, 1915, p. 482.
Zebrasoma hypselopterum Ogilby, Mem. Queensl. Mus. V, 1916, p. 174.
Zebrasoma veliferum Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 66.
Zebrasoma veliferum Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 443.
Zebrasoma veliferum Fowler, Mem. B. P. Bishop Mus. R, 1928, p. 275.
Zebrasoma veliferum Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 255.
Zebrasoma veliferum P. Schmidt, Trans. Pac. Comm. Ac. Sc. USSR. I, 1930, p. 104.
Zebrasoma velifer Borodin, Bull. Vanderbilt Marine Mus. I, Art. 2, 1930, p. 57.
Zebrasoma veliferum Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 346.
Zebrasoma veliferum novae caledoniae Borodin, Bull. Vanderbilt Marine Mus. I, Art. 3, 1932, p. 88.
Zebrasoma veliferum Fortonese, Boll. Mus. Zool. Torino XLV, 1935-1936, p. 40.
Zebrasoma veliferum Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 249.
Zebrasoma veliferum Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 105, p. 120, p. 173.

D. III-IV. 31-32. A. III. 24-26. P. 2. 13-14. V. I. 5.

Height 1.7-2, 2.3-2.4 in length with caudal. Head 3-3.7, 3.8-4.5 in length with caudal. Eye 3.4-3.7, 2.2 in snout and 1-1.2 in convex interorbital space. Body irregularly ovoid. Snout concave, as also the lower profile of head, the mouth being produced. About 8 strongly lobate teeth in the upper jaw, about 10 in the lower jaw, which are only lobate along their upper border. Dorsal beginning slightly behind eye, rounded, very high, the longest rays equalling the height of the body. First dorsal spine very small. Anal also very deep, rounded, the longest rays equal to height of head. Ventrals pointed, as long as snout and half eye. Caudal truncate or very slightly rounded. Colour of preserved specimens dark brown with five or six broad obliquely transverse light bands, the first from origin of dorsal through hindborder of eye to base of ventrals, the second, third, and fourth beginning on dorsal and running: the second behind base of pectoral to origin of anal, the third to anterior part, the fourth to middle of base of anal; the fifth from posterior part of dorsal to that of anal, the sixth, which is often obsolete, from end of dorsal to end of anal. These bands more or less distinctly bordered by narrow black bands. Similar dark bands, parallel to the light ones, in the interspaces between the lastnamed. Snout sometimes spotted with whitish. Dorsal dark brown or blackish, with indistinct light bands in its posterior half, running parallel to the outer border of the fin. Anal sometimes with similar bands. Caudal uniform. Pectorals yellowish or light brown. Ventrals darker. Length 395 mm.

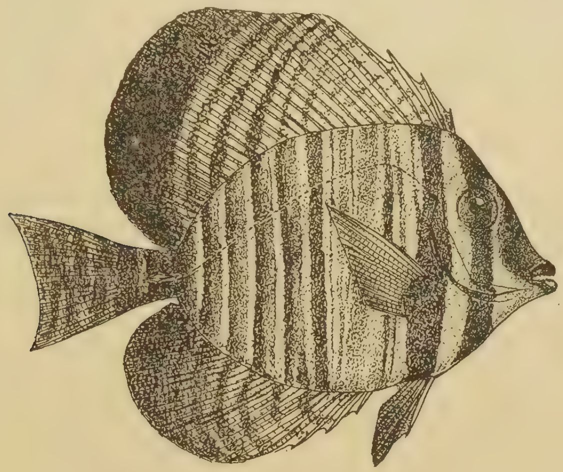

Fig. 28. *Zebrasoma veliferum* (Bl.) n.s.

Habitat: Batu Islands; Celebes (Menado, Limbe Strait); Sulu Islands; Ternate; Gomomo; Batjan; Ceram; Ambon!; Saparua; Flores; Misol; New Guinea (Manokwari, Humboldt Bay!, South Coast). — Madagascar, Mozambique, Zanzibar, Mauritius, Réunion, Seychelles, Coasts of India, Cocos Keeling Islands, Riu Kiu Islands, Philippines, Pelew Islands, Solomon Islands, Coasts of Queensland, New Caledonia, Fiji, Samoa, Society Islands, Paumotu Islands, Hawaii, Pearl & Hermes Reef.

In sea. According to Klunzinger these fishes live along the slopes of coral reefs, not near the surface. They swim in a rather clumsy and uncertain way.

2. **Zebrasoma flavescens** (Benn.)

Acanthurus flavescens Bennett, Zool. Journ. IV, 1828, p. 40.
Acanthurus rhombeus von Kittlitz, Mus. Senckenb. I, Heft 3, 1834, p. 196.
Acanthurus scopas Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 245.
Acanthurus altivelis Cuvier & Valenciennes ibid. p. 249.
Acanthurus scopas Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 348.
Acanthurus scopas Montrouzier, Ann. Sc. phys. Soc. d'Agriculture Lyon (2) VIII, 1856, p. 459.
Acanthurus goramensis Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 208.
Acanthurus rhombeus Günther, Cat. Brit. Mus. III, 1861, p. 342.
Acanthurus flavescens Günther, Fische der Südsee I, 1873-1875, p. 116.
Acanthurus flavescens Sauvage, Poissons de Madagascar, 1891, p. 342.
Acanthurus goramensis Jatzow & Lenz, Abh. Senckenb. Ges. XXI, 1899, p. 514.
Acanthurus flavescens Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 493.
Zebrasoma flavescens Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 555.
Zebrasoma flavescens Jordan & Evermann, Bull. U. S. Fish Comm. XXIII (1903) 1905, p. 377.
Zebrasoma flavescens Jordan & Seale, ibid. XXV (1905) 1906, p. 355.
Zebrasoma rhombeum Jordan & Seale, l.c.
Zebrasoma flavescens rhombeum Jordan & Snyder, Proc. U. S. Nat. Mus. XXIX, 1906, p. 356.
Zebrasoma rhombeum Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 34.
Zebrasoma rhombeum Jordan & Richardson, ibid. XXVII (1907) 1908, p. 270.
Zebrasoma flavescens Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 66.
Zebrasoma flavescens Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 441.
Zebrasoma flavescens Fowler Mem. B. P. Bishop Mus. X, 1928, p. 274.
Zebrasoma rhombeum Fowler, ibid. p. 275.
Zebrasoma flavescens Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 258.
Zebrasoma flavescens P. J. Schmidt, Trans. Pac. Comm. Ac. Sc. USSR I, 1930, p. 103.
Zebrasoma flavescens Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 346.
Zebrasoma flavescens Giltay, Mém. Mus. Royal. Hist. Nat. V, 1933, p. 86.
Zebrasoma flavescens Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 248.
Zebrasoma flavescens Whitley & Colefax, Proc. Linn. Soc. New S. Wales LXIII, 1938, p. 297.
Zebrasoma flavescens Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 233.

D. V. 24-25. A. III. 19-20 (21). P. 2. 13. V. I. 5.

Height 1.4-1.6, 1.7-2 in length with caudal. Head 2.7-3.1, 3.2-3.9 in length with caudal. Eye 2.7-3.3, 2.1-2.5 in snout and a little more or less than the nearly flat interorbital space. Profile of snout very convex, as also of lower profile of head, the mouth being produced. 12 lobate teeth in each ramus of both jaws. First dorsal spine very small, fifth longest, equal to snout and half eye. Anterior rays of soft dorsal longest, seventh and following rapidly decreasing in length. First anal spine small, third longest, intermediate in length between third and fourth dorsal spines. Anterior anal rays longest, posterior rays rapidly decreasing in length, the posterior margin of the fin nearly vertical. Pectorals equal to snout and eye. Ventrals as long as snout. Caudal truncate. Scales on tail before spine with long stiff bristles, forming a brushlike patch. Colour of preserved specimens dark brown, the fins included. In the *Acronurus* stage the body is longitudinally banded as in the adult of *veliferum*. Length 210 mm.

Habitat: Batu Islands; Java!; Birabirahan Island; Danawan and Si Amil Islands; Tawi Tawi Islands; Sulu Islands; Talisse Island; Celebes (Gulf of Tomini); Halmahera; Gébé; Ternate; Tidore; Kajoa; Buru; Ceram; Ambon; Nusa Laut; Banda; Flores; Solor; Timor; New Guinea (Manokwari, Port Moresby). — Madagascar, Mozambique, Zanzibar, Mauritius, Réunion, Japan, Riu Kiu Islands, Philippines, Marianas, Marcus Island, Carolines, New Britain, Solomon Islands, Woodlark Island, New Hebrides, Gilbert Islands, Rotuma, Fiji, Samoa, Society Islands, Hawaii, Johnston Island, Laysan. In sea.

6. **Naso** Lacepède

(Lacepède Hist. Nat. Poissons III, 1802, p. 104)

Naseus Lacepède, ibid. p. 105.
Monoceros Bloch Schneider, Syst. Ichth. 1801, p. 180.
Priodon Quoy & Gaimard, Voyage Uranie & Physicienne, Zool. 1825, p. 377.
Axinurus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 299.
Keris Cuvier & Valenciennes, ibid., p. 304.

Oblong or elongate, compressed, covered with minute, ctenoid, rugose scales, those of anterior part of body and of head larger, polygonal. Forehead in adults often with a prominent bump or a horn-like protuberance. Mouth small, terminal. Jaws equal, with a single series of pointed serrulated or smooth teeth. Gill openings rather wide, but restricted to the sides, the gill membranes attached to the isthmus. On each side of the caudal peduncle one or two immovable bony buckles, provided with a triangular compressed keel or a rigid spine, not developed in young. Dorsal with V-VI spines and 26-31 rays. Anal with II spines and 26-30 rays. Ventrals with I spine and 3 rays. Caudal truncate or emarginate, the lobes sometimes filamentous.

Distribution. Red Sea, tropical parts of Indic and Pacific.

Key to the Indo-Australian species of Naso

- I. Two caudal plates on each side of caudal peduncle, exceptionally two on one side, one on the other.
  - A. A horn-like protuberance on forehead in adults 1).
    - *a*. Snout below horn long, its upper profile oblique. Caudal lobes produced into filaments. Height 2.3-2.5 . . . . 1. *N. unicornis* p. 173.
    - *b*. Snout below horn short. Caudal lobes not produced.
      - a^1. Profile of snout below horn subvertical. Height 2.2-2.7 . . . . 2. *N. brevirostris* p. 175.
      - b^1. Profile of snout below horn oblique.
        - a^2. Horn horizontal. Height 2.72-2.84 . . . . 3. *N. brachycentron* p. 177.
        - b^2. Horn more or less directed obliquely downwards. Height 2-2.3 . . . . 4. *N. annulatus* p. 177.
  - B. A convex, compressed hump on forehead in adults 1).
    - *a*. D. VI. 26. Longitudinal stripes on sides. Caudal lobes filamentous . . 5. *N. vlamingii* p. 178.
    - *b*. D. V. 27-29. Body with small dark spots. Caudal lobes not produced . . 6. *N. tuberosus* p. 180.
  - C. Forehead without horn or hump.
    - *a*. D. V. 31. A. II. 30. Height 3-3. 2. Spotted with dark . . . . 7. *N. lopezi* p. 181.
    - *b*. D. VI. 28-29. A. II. 28-29. Height 2.4-2.9. Uniform brown . . . . . 8. *N. hexacanthus* p. 182.
    - *c*. D. VI. 28-29. A. II. 28-29. Height 2-2.2. A yellow band from anterior lower border of eye downwards to behind corner of mouth. Caudal bucklers in a light area. . . . . 9. *N. lituratus* p. 183.
    - *d*. D. V. 29. A. II. 28 (29). Height 2.3. Brown, anal with two dark brown

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1) As in semi-adults the horn is developed as a hump, this key must be used with caution.

streaks . . . . 10. *N. tapeinosoma* p. 184.
e. D. VI. 27-28. A. II. 28-29. Opercle surrounded by a deep brown band . 11. *N. genimarginatus* p. 185.
II. Only one caudal plate on each side of caudal peduncle. Forehead without horn or bump. D. III-V. 28-30 . . . . 12. *N. thynnoides* p. 186.

1. **Naso unicornis** (Forsk.). (Fig. 29, p. 174)

Chaetodon unicornis Forskål, Descr. Animalium, 1775, p. 63.
Monoceros biaculeatus Bloch Schneider, Syst. Ichth. 1801, p. 180.
Monoceros Raii Bloch Schneider, ibid. p. 181.
Naso fronticornis Lacepède Hist. Nat. Poissons III, 1802, p. 105, p. 106.
Aspisurus unicornis Rüppell, Atlas Reise N. Afrika. Fische, 1828, p. 60.
Naseus fronticornis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 259.
Naseus olivaceus Cuvier & Valenciennes, ibid. p. 288.
Harpurus Monoceros Forster Lichtenstein, Descr. Animal. 1844, p 219.
Priodon anginosus Bleeker, Nat. Tijdschr. Ned. Indië VI, 1854, p. 492 (nec C. V.?).
Naseus fronticornis Bleeker, ibid. XII, 1856-1857, p. 238.
Naseus unicornis Günther, Cat. Brit. Mus. III, 1861, p. 348.
Naseus olivaceus Günther, ibid. p. 352.
Naseus unicornis Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 512.
Naseus unicornis Günther, Fische der Südsee I, 1873-1875, p. 118.
Naseus unicornis Day, Fishes of India, Part II, 1876, p. 209.
Naseus unicornis Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 164.
Naseus unicornis Klunzinger, Fische des rothen Meeres I, 1884, p. 86.
Naseus unicornis Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 495.
Monoceros marginatus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 114 (nec C. V.).
Acanthurus unicornis Jordan & Evermann, Bull. Fish. Comm. XXIII (1903) 1905, p. 402.
Acanthurus unicornis Seale, Occas. Papers B. P. Bishop Mus. IV, 1906, p. 67.
Acanthurus unicornis Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 357.
Acanthurus unicornis Ogilby, Mem. Queensl. Mus. III, 1905, p. 135.
Naseus (tapeinosoma?) M. Weber, Siboga Exp. Fische, 1913, p. 321.
Naso unicornis Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 67.
Monoceros unicornis Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 781.
Naso unicornis Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 455.
Naso unicornis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 277.
Naso unicornis Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 264.
Naso unicornis Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 346.
Prionolepis hewitti J. L. B. Smith, Rec. Alb. Mus. IV, 1935, p. 145.
Monoceros unicornis J. L. B. Smith, ibid. p. 209.

D. V-VI. 28-31. A. II. 26-30. P. 2. 15. V. I. 3.

This species seems to be variable. The profile of the head varies greatly according to the figures given by Günther (1871) and Fowler & Bean (Fig. 29). I have only examined two specimens, one described by Bleeker as *fronticornis* (l.c.) which is a very old individual, measuring 620 mm according to Bleeker, but this is probably a misprint, as I find its length to be 530 mm. Its horn is as long as that of the specimen of 550 mm figured by Günther. It has also a large hump on the back below the anterior dorsal rays. The second specimen, 117 mm long, is the one recorded by M. Weber as *tapeinosoma*?. It agrees with the figure of Günther (1871 Plate 78, fig. B) but the dorsal, anal, and caudal have white edges and there is an indistinct white ring round the caudal peduncle. The lips are also white. These markings point to *annulatus,* but the snout in the young of this species is shorter and less concave. Both specimens examined have: D. V. 29 (30). A. II. 27-29. P. 2. 15. Height 2.3-2.5, 2.8-3.1 in length with caudal. Head 3.2-4.3, 3.9-5.3 in length with caudal. Eye 3.3-5, 2.1-4.5 in snout, and 1.1-1.4 in the interorbital space, which is flat but somewhat keeled. First dorsal spine longest, fin gradually decreasing in height posteriorly. Anal similar to dorsal. Pectorals equal to snout in the young specimen, one eye diameter shorter than distance be-

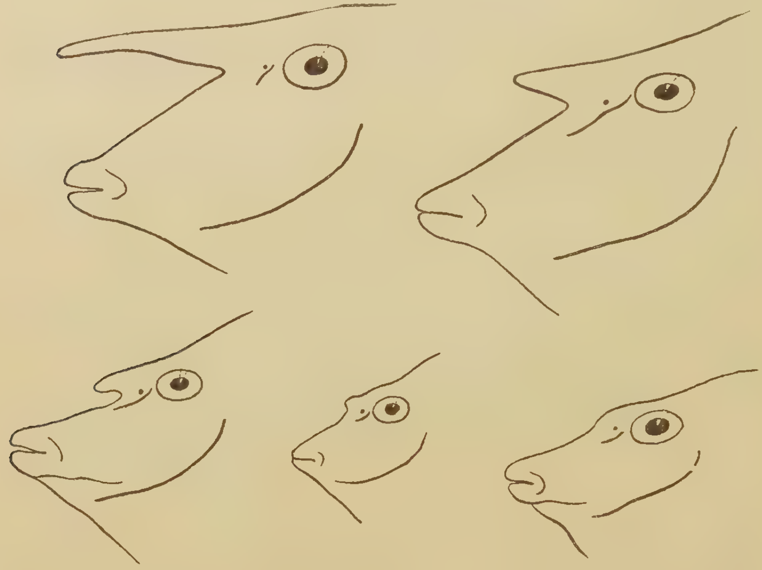

Fig. 29. Rostral variations with age of *Naso unicornis* (Forskål). After Fowler.

tween eye and corner of mouth in the large one. Ventrals less than half snout in the old specimen, equal to distance between corner of mouth and eye in the juvenile one. Caudal emarginate in the young, lunate and with produced lobes in the adult. In the young specimen the two bucklers on caudal begin to develop, in the old specimen they are large rounded plates with a high triangular pointed keel. Colour of the preserved specimens uniform brownish. In the *Keris* stage there is a dark band on nape, and about 6 transverse series of dark spots on the body. Dorsal with basal dark spots and more or less distinct oblique dark longitudinal bands.

Habitat: Batu Islands!; Sulu Islands; Celebes (Menado!, Kait Point, Libani Bay); Ternate; Ceram; Ambon; Flores; Timor; Waigeu; New Guinea (Port Moresby). — Madagascar, Mauritius, Réunion, Mozambique, Red Sea, Coasts of India, Ceylon, China, Japan, Riu Kiu Islands, Formosa, Philippines, Marianas, Nauru, Torres Straits, Coast of Queensland, New Hebrides, Lord Howe Island, Rotuma, Samoa, Society Islands, Tubuai Islands, Laysan, Hawaii. In sea.

2. **Naso brevirostris** (C. V.).

Naseus brevirostris Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 277.
Keris amboinensis Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 272.
Naseus brevirostris Bleeker, ibid. V, 1853, p. 165.
Naseus Hoedtii Bleeker, ibid. p. 339.
Priodon amboinensis Bleeker, ibid. VI, 1854, p. 495.
Naseus brevirostris Bleeker, ibid. IX, 1855, p. 306.
Naseus amboinensis Bleeker, ibid. XIII, 1857, p. 372.
Naseus brevirostris Günther, Cat. Brit. Mus. III, 1861, p. 349.
Keris amboinensis Günther, ibid. p. 356.
Naseus brevirostris Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 511.
Naseus brevirostris Günther, Fische der Südsee I, 1873-1875, p. 121.
Naseus brevirostris Day, Fishes of India, Part II, 1876, p. 209.
Naseus brevirostris Klunzinger, Fische des rothen Meeres I, 1884, p. 86.
Acanthurus brevirostris Jenkins, Bull. U. S. Fish Comm. XXII (1902), 1904, p. 481.
Acanthurus brevirostris Jordan & Evermann, ibid. XXIII (1903) 1905, p. 401.
Acanthurus brevirostris Steindachner, Sitzber. Akad. Wien CXV, 1906, p. 1394.
Acanthurus brevirostris Kendall & Goldsborough, Mem. Mus. Comp. Zool. XXVI, N° 7, 1911, p. 311.
Naseus amboinensis M. Weber, Siboga Exp. Fische, 1913, p. 321.
Naso brevirostris Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 277.
Naso brevirostris Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 268.

Naso brevirostris Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 250.
Naso brevirostris Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 128.

D. VI. 28-29. A. II. 28-29. P. 2. 14. V. I. 3.

Height 2.2-2.7, 2.6-2.8 in length with caudal, measured from tip of snout to end of caudal. Head 4-4.2, 4.8-5 in length with caudal. Eye 3.1-4.4, 1.9-2.8 in snout and 1-1.8 in convex and slightly keeled interorbital space. Frontal horn horizontal, its axis in the level of the middle of the eye. In a specimen of 135 mm it is developed as a bump, not projecting beyond the vertical through anterior end of jaws, in a specimen of 183 mm it reaches that vertical, and in a specimen of 335 mm, the largest examined, it projects far before the mouth, its length being 3.9 diameters of eye. Profile of snout between horn and mouth vertical, subvertical in young specimens, 18-24 pointed crenulate teeth in each ramus of both jaws, the anterior ones in the upper jaw longer than the others. Origin of dorsal a short distance behind vertical through hindborder of eye. Spines strong, heteracanth, subequal, as long as snout or somewhat shorter in large specimens. Dorsal rays gradually decreasing in length posteriorly, the last 1-1.5 diameters of eye. Third anal spine longer than second, less than dorsal spines in length; anal rays slightly decreasing in length posteriorly. Anal less deep than dorsal. Pectorals as long as snout and eye or snout and half eye. Ventral spine strong, longer than dorsal spines. Caudal truncate or slightly emarginate. Two spines on each side of caudal peduncle, small and knob-like in young, blade-like in adults. Colour of preserved specimens purplish brown, somewhat lighter below. Body with indistinct dark vertical bands on back and sides, spotted on belly. Dorsal and anal purplish brown, indistinctly barred longitudinally with lighter. Caudal dark, distal third creamy white. Pectorals and ventrals dark. Length 428 mm.

Habitat: Pulu Weh!; Singapore; Java (Karangbollong); Bawean; Bali; Sulu Islands; Sangir Islands; Celebes (Makassar, Badjoa, Menado); Saleyer!; Goram; Ceram; Buru; Ambon; Ternate; New Guinea. — Zanzibar, Mauritius, Réunion, Seychelles, Red Sea, Coasts of India, Riu Kiu Islands, Formosa, Philippines, Pelew Islands, Solomon Islands, New Hebrides, Kingsmill Islands, Samoa, Society Islands, Paumotu Islands, Hawaii. In sea.

Note. Günther was of opinion, that *Keris amboinensis* is closely related to *N. annulatus.* Fowler & Bean associated it with *N. unicornis,* but I think that the striped dorsal and anal, and the light distal half of the caudal make it probable, that it is the young stage of *brevirostris.*

3. **Naso brachycentron** (C. V.)

Naseus brachycentron Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 275.
Naso brachycentron Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 448.

D. V. 28-29. A. II. 27-28.

Height 2.72-2.84. Head 3.9-4, the forehead produced into a very long, slender, tapering cylindrical horn which extends far beyond mouth, its axis passing through center of eyes or sometimes through upper third of eye; from eye to tip of horn its length varies from a little more than head to 1.4 times head. Upper profile below base of horn forms a steep straight line, about 3 times in head; it is a trifle less than distance from eye to front dorsal spine. Eye 4.8-5, 3-3.33 in snout, 1.85-2 in the broad keeled interorbital space. Teeth small, conical, serrulate, about 33 on each side in upper jaw. First dorsal spine 3-3.7 in head. Dorsal rays equal to or exceeding the spines in height, about 3 in head. Dorsal angulate posteriorly. Anal spines 4-5.66 in head. Dorsal angulate posteriorly. Anal spines 4-5.66 in head. Anal like dorsal, but lower, the rays 3.7 in head. Pectorals about 1.66 in head. Ventral spine 3 in head. Caudal broad, nearly truncate, the broad rays pinnate and lobate on posterior margin. On each side of caudal peduncle two large oval bony plates, the anterior one larger and equal to eye; each with a high, keen-edged, knifelike keel, variable in shape. Colour in alcohol dark purplish plum or olive, nearly black, on head and dorsally, and becoming paler purplish brown to violet-brown on sides and below; throat and breast may be violet-gray; dorsal and anal very dark purplish brown; pectoral deep brown with a white posterior margin; the caudal has more or less yellow or whitish yellow, mostly as stripes between the feather-like rays. Length 515 mm (After Herre, not seen by me).

Habitat: Waigeu. — Philippines.

4. **Naso annulatus** (Q. G.).

Priodon annulatus Quoy & Gaimard, Voyage Uranie et Physicienne. Zool. 2. Partie, 1824, p. 377.
Naseus marginatus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 280.

Priodon annularis Cuvier & Valenciennes, ibid. p. 302.
Priodon annularis Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 558.
Naseus annulatus Bleeker, ibid. IX, 1855, p. 304.
Naseus annulatus Günther, Cat. Brit. Mus. III, 1861, p. 352.
Naseus marginatus Günther, Fische der Südsee I, 1873-1875, p. 122.
Naseus annulatus Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 163.
Monoceros annulatus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 113.
Acanthurus annulatus Fowler & Bean, Proc. U. S. Nat. Mus. LXII 1922, Art. 2, p. 57.
Naso marginatus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 452.
Naso annulatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 277.
Naso annulatus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 271.
Naso annulatus Fowler, Monogr. Ac. Nat. Sc. Philadelphia II, 1938, p. 234.

D.V. 28. A. II. 28 (29). P. 2. 15. V. I. 3.

Height 2-2.3, 2.4-2.8 in length with caudal. Head 3.6-3.8, 4.4 in length with caudal. Eye 2.8-3.2, 1.8-2 in snout and somewhat less or more than interorbital space, which is convex. In young ones there is a bump just before eye, which develops in very large specimens into a horn like protuberance, which is generally directed somewhat obliquely downwards. First dorsal spine longest, as long as distance between corner of mouth and eye; following spines and rays decreasing in size, the last ray equal to half eye. First and second anal spines subequal, three fourths of eye. Anal similar to dorsal. Caudal slightly emarginate. Two keeled bucklers on each side of caudal peduncle in adults. In a specimen of Bleeker's collection in the Leiden Museum there is a specimen of 220 mm length which has only one buckler on the left side but two on the right side. Colour of preserved specimens brownish. Length 315 mm (Specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Batu Islands; Sumatra (Kauer); Java (Patjitan); Bali; Borneo (Sandakan); Danawan; Celebes (Makassar); Sadaja; Sulu Islands; Ternate; Ceram; Buru; Ambon; Goram; Timor; New Guinea (Moresby Bay). — Zanzibar, Philippines, Pelew Islands, Yap, Marianas, New Hebrides, Coast of Queensland, Fiji, Tonga Islands, Samoa, Society Islands, Hawaii. In sea.

5. **Naso vlamingi** (C. V.).

Naseus Vlamingii Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 293.
Naseus Vlamingii Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 472.
Naseus tuberosus Günther, Cat. Brit. Mus. III, 1861, p. 353 (pro parte).
Naseus vlamingii Günther, Fische der Südsee I, 1873-1875, p. 123.

Monoceros vlamingii Fowler, Proc. Acad. Nat. Sc. Philadelphia 1899, p. 493.
Naso vlamingii Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 459.
Naso eoume Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 276 (nec Lesson).
Naso eoume Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p 275 (nec Lesson).
Naso eoume Fowler, Mem. B. P. Bishop Mus. XI, N° 3, 1931, p. 347. — Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 128 (nec Lesson).

D. VI. 26 (27). A. II. 26 (27). P. 2. 15. V. I. 3.

Height 2.2, 3.1 in length with caudal. Head 4, 5.5 in length with caudal. Eye 3.7, 2.4 in snout and 1.3 in convex slightly keeled interorbital space. Snout convex in young, developing into a convex hump with age, the rounded end of which does not or scarcely extends beyond vertical through anterior end of the mouth. About 25 pointed teeth, the sides of which show microscopical denticulations, in each ramus of both jaws. Origin of dorsal in vertical between eye and gill opening. Dorsal spines slightly increasing in size posteriorly, the last equal to snout. Anterior dorsal rays higher than spines, the longest equal to snout and half diameter of eye; posteriorly the fin gradually decreases in height, the last ray being half as long as snout. Anal similar in shape to dorsal, but less deep. Pectoral nearly as long as snout and half eye. Ventral spine scarcely longer than last dorsal spine. Caudal truncate, the lobes produced into long thin curved filaments. Caudal spines in adults blade-like, somewhat pointed. Colour of preserved specimen brownish. Back with rounded light blue spots, more or less arranged in longitudinal rows, inferiorly the spots are elongate in a vertical direction and still lower down they are replaced by narrow parallel stripes on the sides and tail, dissolved again into spots on the belly, where they are smaller and more crowded than on the back. Some similar spots on the head and on thorax. Fins and caudal bucklers violet brown. Length 780 mm.

Nomen indig. Galak Karang.

Habitat: Java (Jacarta); Bawean; Danawan; Sulu Islands; Celebes (Makassar, Gulf of Tomini, Kait Point); Limbe Strait; Gomomo; Flores; Ceram; Nusa Laut! — Laccadives, Formosa, Philippines, Marshall Islands, Carolines, New Britain, New Hebrides, Society Islands, Paumotu Islands, Marquesas Islands, Fanning Islands. In sea.

Note. Fowler considers *vlamingi* as a synonym of *eoume* Lesson (Voyage Coquille, Zool. 1re Partie. 1830, p. 151). The two species agree in the number of dorsal rays and in the fila mentous caudal. Lesson describes the colour as dark brown, the caudal buckles orange, a yellow stripe from preopercle upwards to eye, a blue band from forehead to caudal, a white band from ventrals to caudal buckle. Nothing of these markings can be seen in *vlamingi* and I think it very improbable that they are the same species. There is more reason to suppose that *eoume* is a synonym of *lituratus,* a view accepted by most authors.

6. **Naso tuberosus** Lac.

Naso tuberosus Lacepède, Hist. Nat. Poissons III, 1802, p. 105, p. 111.
Naseus tuber Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 290.
Naseus tuberosus Günther, Cat. Brit. Mus. III, 1861, p. 353. — Fische der Südsee I, 1873-1875, p. 123 (pro parte).
Naseus punctulatus Steindachner, Sitzber. Akad. Wien LXX. 1. Abth. 1874, p. 386 (nec C.V.?).
Naseus tuberosus Day, Fishes of India, Part II, 1876, p. 208.
Monoceros tuberosus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 510.
Naso tuberosus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 458.
Naso tuberosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 276.
Naso tuberosus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 273.
Naso (Cyphomycter) tuberosus Whitley, Mem. Queensl. Mus. X, Part I, 1930, p. 18.

D. V. 27-29 (30). A. II. 26-27 (28).

A bump on snout, scarcely developed in young, almost projecting beyond mouth in large specimens. Height 2.25-2.75. Head 3.6-4. Eye 3.2-5.3, 2.25-4.1 in snout, 1.1-2 in interorbital space. 40-42 (30-34 in young) compressed, pointed, minutely serrated teeth in each jaw. First dorsal spine 2.6 in head, first dorsal ray 2.5-3. Second anal spine 3.25-5, first anal ray 3.5-3.9 in head. Caudal deeply emarginate in young, nearly truncate with age. Caudal peduncle with 2 bony bucklers, each with a broad, strongly compressed, recurved spine. Olivaceous brown on back, paler or quite light below. Back and upper side covered with slightly darker, small, round spots, each greatly less than pupil and of more or less similar size, extending over head in some specimens. Dorsal and anal dark brown, broadly margined whitish, each with 2 longitudinal rows of dark to blackish-brown spots in dark area of each membrane. Caudal brown, becomes dusky submarginally with narrow white border and dark subterminal area with obscure scattered dark small spots, less distinct or absent with age. Pectorals brown, becoming neutral dusky submarginally and edge broadly whitish, narrowly so with age. Ventrals pale to whitish, with several brown spots. Length over 600 mm (not seen by me, copied after Fowler & Bean).

Habitat: North Celebes; Misol; Schouten Islands; New Guinea. — Zanzibar, Mauritius Réunion, Ceylon, Riu Kiu Islands, Philippines, Guam, Coast of Queensland, New Hebrides, Gilbert Islands. In sea.

7. **Naso lopezi** Herre

Naso lopezi Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 467.
Naso vomer Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 282 (nec Klunz.).
Naso lopezi Herre, Notes Fish Zool. Mus. Stanf. Univ. 1934, p. 63.

D. V. 31. A. II. 30.

Elongate, fusiform. Height 3-3.3. Head 4-4.1. Eye high up, 4.33-4.5, 2.8 in snout, two thirds as long as the broad, nearly flat interorbital space. Teeth small, with long, pointed, minute serrate tips, 30 on each side in the upper jaw. Anterior nostril with a slight marginal flap. First dorsal spine longest and strongest, 2.4 in head, the others progressively slightly shorter. Dorsal low, angulate posteriorly, the longest rays 3.5-3.6 in head. First anal spine 3.4-4 in head, second spine shorter and more slender. Anal rays like dorsal in shape and height. Depth of caudal peduncle 5.2-5.6 in head, less than eye, and less than its own breath. Pectorals rather blunt, 1.6 to nearly 1.7 in head. Ventral spine and first ray about equal in length, about 2.5 in head. Caudal slightly lunate, the lobes more or less pointed. On each side of caudal peduncle are two ovate bony plates, the posterior one partly on caudal fin, the anterior one well separated, each bearing a thin sharp-edged elevated keel, rounded in outline or the anterior margin vertical. Colour in alcohol rich brown or violet brown above, paler on sides, greyish brown below and grey on throat. One specimen has the cheeks bright silvery. Upper half of body thickly sprinkled with dark brown circular spots, not many below the median line, a few on opercle and preopercle. A very large irregular golden yellow blotch behind head and partly covered by pectoral. Caudal thickly covered with brown spots like those on body, with a broad greenish yellow posterior marginal band, with a terminal white band. Spinous dorsal covered with large violet brown circular spots and irregular pale streaks. Membrane of soft dorsal deep violet, or spotted like spinous dorsal;

that of anal violet brown, apparently with paler stripes. Length 410 mm. (After Herre, not seen by me).

Habitat: Sulu Islands. — Philippines.

8. **Naso hexacanthus** (Blkr.)

Priodon hexacanthus Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 421.
Naseus hexacanthus Steindachner, Abh. Senckenb. naturf. Ges. XXV, 1900, p. 427.
Callicanthus metoposophron Jenkins, Bull. U. S. Fish. Comm. XXII (1902) 1904, p. 481.
Callicanthus metoposophron Jordan & Evermann, ibid. XXIII (1903) 1905, p. 405.
Callicanthus metoposophron Jordan & Snyder, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 125.
Naso hexacanthus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 463.
Naso hexacanthus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 278.
Naso hexacanthus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 280.
Naso hexacanthus P. J. Schmidt, Trans. Pacif. Comm. Acad. Sc. USSR I, 1930, p. 104. — Bull. Acad. Sc. URSS, 1930, p. 556.
Naso hexacanthus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 234.

D. VI. 28-29 (30). A. II. 28-29 (30). P. 2.15. V. I. 3.

In a young specimen of 158 mm the profile of the head, which is deeper than long, is very convex, in an old specimen of 450 mm the head is longer than deep, the snout being relatively much longer and the profile sloping down in a slightly convex line. Height 2.4-2.9, 2.9-3.1 in length with caudal. Head 4.1-4.4, 4.8-4.9 in length with caudal. Eye 3.2-4.7, 1.7 in snout in young, 2.8 in old specimens. Interorbital space convex and somewhat keeled in young, slightly less than eye; in old specimens the eye goes 1.6 in the very convex interorbital space. About 22 slightly serrated pointed teeth in each ramus of both jaws. Third dorsal spine longest, equal to or somewhat shorter than snout. First anal spine equal to or a little more than half length of snout. Pectorals as long as snout or as snout and half eye in young. Ventral spine nearly equal to (in old specimens) or a little more than distance between corner of mouth and eye. Caudal emarginate. Colour of preserved specimens uniform brown. Length 710 mm. (Typical specimens of Bleeker's collection in the Leiden Museum examined).

9. **Naso lituratus** (Bl. Schn.)

Acanthurus lituratus Bloch Schneider, Syst. Ichth. 1801, p. 216.
Aspisurus elegans Rüppell, Atlas Reise N. Afrika. Fische, 1828, p. 61.
Naseus lituratus Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 282.
Harpurus lituratus Lichtenstein, in Forster Descr. Animal. 1844, p. 218.
Naseus lituratus Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 763.
Naseus lituratus Günther, Cat. Brit. Mus. III, 1861, p. 353.
Naseus lituratus Kner, Novara Exp. Fische I, 1865-1867, p. 213.
Naseus lituratus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 513.
Naseus lituratus Günther Fische der Südsee I, 1873-1875, p. 124.
Naseus (Aspisurus) lituratus Klunzinger, Fische des rothen Meeres I, 1884, p. 87.
Naseus lituratus Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 495.
Monoceros lituratus Seale, Occas. Papers B. P. Bishop Mus. I, 1901, p. 113.
Callicanthus lituratus Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 481.
Callicanthus lituratus Jordan & Evermann, ibid. XXIII (1903) 1905, p. 404.
Acanthurus lituratus Jordan & Seale, ibid. XXV (1905) 1906, p. 358.
Naseus lituratus M. Weber, Siboga Exp. Fische, 1913, p. 320.
Naso lituratus Herre, Philipp. Journ. Sc. XXXIV, N° 4, 1927, p. 464.
Naso lituratus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 276.
Naso lituratus Fowler & Bean, Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 278.
Naso lituratus Fowler, Mem. B. P. Bishop Mus. XI, N° 5, 1931, p. 347. — ibid. N° 6, 1934, p. 428.
Naso lituratus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 251.
Naso lituratus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 105, p. 233.

D. VI. 28-29. A. II. 28-29. P. 2. 15. V. I. 3.

Height 2-2.2, 2.5-2.8 in length with caudal. Head 3.3-3.7, 4.1-4.6 in length with caudal. Eye 3.3-5.3, 2.3-4.1 in snout and 1-1.5 in almost flat interorbital space. Upper profile from dorsal to tip of snout very oblique, snout slightly concave in young. No frontal horn or bump. Mouth slightly produced. About 14 moderate teeth with rounded tips in each ramus of both jaws. Origin of dorsal above upper extremity of gill opening. Dorsal spines heteracanth, the first or the second longest, more than twice diameter of eye. Following spines and rays slightly and gradually decreasing to the last, which is more than eye. Second anal spine longer than first, shorter than last dorsal spine. Soft anal similar to soft dorsal. Pectorals equal to distance between eye and corner of mouth. Ventral spine strong, about five seventh of pectoral. Caudal lunate, truncate when expanded, the lobes produced into filaments with age, growing larger as the fish grows. Colour of preserved specimens velvety brown or grey. A yellow or orange band from anterior lower border of eye downwards to behind corner of mouth, deflected and curved in its lower part, sometimes united to a band of similar colour, which borders the preopercle behind. Rims of nostrils white. Interorbital space and region above and behind eye sometimes orange, sometimes dark and with a large light patch immediately before dorsal. Caudal spines each in a light yellowish area, the two sometimes confluent. Dorsal black in its basal half, creamy with a narrow black terminal edge in its distal half. In young specimens the spinous part of the fin is almost entirely black, but with age the white increases and in large specimens the spinous portion is almost entirely white, with a narrow black basal part. Anal brown or grey as the body, sometimes with a white narrow terminal and a narrow black subterminal edge. In another specimen the anal is of the same colour as the dorsal, basally dark, rest light with a narrow dark edge. Pectorals dark brown, ventrals greyish as also sometimes the median part of the belly. Caudal brown or grey, with a broad white hinder edge followed by a more or less distinct broad black one, which merges into the black prolonged lobes in adults. Length 500 mm.

Habitat: Batu Islands; Java (Jacarta)! Danawan Island; Karkaralong Reef!; Sangi Islands; Celebes (Makassar); Kaioa; Ambon; Ceram!; Flores; Adonara!; Timor!; New Guinea (Manokwari, Moresby Bay). — Red Sea, Coast of Natal, Zanzibar, Mauritius, Philippines, Mariannas, New Ireland, Solomon Islands. Coasts of Australia, Santa Cruz Islands, New Hebrides, Kingsmill Islands, Funafuti, Rotuma, Ninafou Island, Samoa, Cook Islands, Society Islands, Paumotu Islands, Hawaii. In sea, on and near coral reefs.

10. **Naso tapeinosoma** (Blkr.)

Priodon tapeinosoma **Bleeker,** Nat. Tijdschr. Ned. Indië VI, 1854, p. 494.
Naseus tapeinosoma Bleeker, ibid. IX, 1855, p. 306.

D. V. 29. A. II. 28 (29). P. 2. 15. V. I. 3.

Height 2.8, 3.2 in length with caudal. Head 3.9, 4.5 in length with caudal. Eye 3.6, 2.1 in snout and 1.2 in somewhat convex interorbital space. Profile of head very gently sloping from dorsal to snout, where it is slightly convex. Corner of mouth much nearer to hindborder of preopercle than to eye. More than 20 slightly serrate pointed teeth in each ramus of upper jaw. First dorsal spine slightly shorter than second, which is subequal to third and equal to distance between eye and corner of mouth;

following spines and rays decreasing in length to the last, which is less than eye. Anal similar to dorsal. Pectorals as long as snout. Ventral spine three fourths of length of pectoral. Caudal slightly emarginate, almost truncate when the fin is expanded. Colour of preserved specimen yellowish brown. Two indistinct dark longitudinal bands on anal. Length 215 mm. (Description made after a specimen of Bleeker's collection in the Leiden Museum).

Habitat: Ambon; Timor. In sea.

Note. The species described by Fowler & Bean (Bull. U. S. Nat. Mus. 100. Vol. VIII, 1929, p. 283) as *tapeinosoma,* cannot be this species as it has only 24-25 (26) dorsal rays and 23 (24) anal rays.

11. **Naso genimarginatus** Herre

Naso genimarginatus Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 461. — Notes Fish Zool. Mus. Stanf. Univ. 1934, p. 63.

D. VI. 27-28. A. II. 28-29.

Elongate, fusiform. Height 2.6. Head 4-4.14. Eye 5-5.4, 3 in snout, and twice in strongly convex interorbital space. About 40 minute teeth in each side of upper jaw, their elongate pointed tips more or less microscopically serrate. Dorsal spines comparatively slender, the first or first and fourth longest, 2.4-3 in head. Dorsal low, the longest rays 2.6-2.8 in head. Anal spines short, 3.4-3.8 in head. Anal lower than dorsal, the longest rays 3-3.5 in head. Caudal peduncle very broad, flattened above and below, its height 6.6-6.9 in head and 1.4-1.68 in its own width. Pectorals 1.55, ventrals 2.2-2.4 in head. Caudal lunate or nearly truncate. Colour dark purplish brown above and on sides of head, lighter below. Opercle enclosed by a very broad chocolate brown band, which extends forward to apex of isthmus beneath chin. Vertical fins purplish brown. In life golden yellow spots and streaks on dorsal membrane. Anal and ventral golden yellow. Posterior margin of caudal has a broad greenish yellow band. Length 452 mm. (After Herre, not seen by me).

Habitat: Sulu Islands; Ambon?. — Philippines.

Note. The *Keris*-stage described by me in Bijdr. Dierk. Afl. XIX, 1913, p. 126 from Ambon may belong to this species. It has D. VI. 27, A. II. 27. Height 2.6. Brown. A very narrow brown line encircles the opercle. Ventrals, dorsal, and anal black, edged with white. Caudal dusky, with a white mark basally in the form of a 3 when seen from the left side, the rest of the fin white mottled with darker.

1. **Naso thynnoides** (C. V.)

Axinurus thynnoides Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 290.
Naseus thynnoides Bleeker, Acta Soc. Sc. Indo-Neerl. II, 1857. Achtste bijdr. vischf. Amboina, p. 61.
Naseus thynnoides Günther, Cat. Brit. Mus. III, 1861, p. 355.
Naso thynnoides Herre, Philipp. Journ. Sc. XXXIV, 1927, p. 469.
Naso thynnoides Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 275.
Naso thynnoides Fowler & Bean, Bull. U. S. Nat. Mus. Vol. VIII, 1929, p. 285.

D. IV. 30 (31). A. II. 29-30. P. 2. 15. V. I. 3.

Height 2.9-3.2, 3.5-3.6 in length with caudal. Head 4.2-4.4, 4.9-5.2 in length with caudal. Eye 3-3.2, 1.3-1.7 in snout and equal to the almost flat interorbital space. Head conical. Dorsal profile of head sloping down in a straight line from dorsal to eye and with a slight covexity to mouth. Teeth slender, pointed, smooth. First dorsal spine somewhat shorter than second, third, and fourth, which are subequal, the fourth slightly shorter than snout. The fin gradually decreasing in height behind the fourth, the last ray shorter than eye. Anal similar to dorsal. Pectorals equal to snout and half eye. Ventral spine slightly shorter than snout. Caudal slightly forked. Only one buckler on each side of caudal peduncle. Colour of preserved specimens brown above, light below. Length 362 mm. (Specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Basa Reef, Gulf of Boni; Limbe Strait; Doworra; Ambon!; New Guinea. — Formosa, Philippines. In sea.

Doubtful species

Naso tripeltis C. V.

Naseus tripeltis Cuvier & Valenciennes, Hist. Nat. Poissons X, 1835, p. 276.

This species is based on a drawing made by Vlaming in the East Indias, and reproduced in Renard (Hist. Nat. des plus rares curiosités de la mer des Indes, etc. 1754, T. 1. pl. 4, fig. 23). This figure represents a *Naso* with a horizontal horn not reaching farther than the end of the snout. The body is rather elevated. There are three not very distinct spines on each side of the caudal peduncle. The colour is brown, darker above, with a blue longitudinal band from head to caudal peduncle. In this band six black blotches. The band is bordered above by a light red narrow band. Dorsal and anal brown with 2 longitudinal blue bands. Caudal filamentous, brown, with a blue vertical band. The buckler red.

No fish resembling this drawing has ever been found.

6. Suborder SCOMBROIDEA

Elongate, compressed or much compressed, covered with small, generally cycloid scales, or partly or entirely scaleless. Lateral line complete, generally distinct, seldom double. Two nostrils on each side of the snout. Cranium with the orbito-rostral portion elongate or even much elongate and the postorbital part abbreviate. Maxillaries more or less firmly attached to the non-protractile premaxillaries, which are typically produced and pointed anteriorly. Teeth in the jaws often in a single series, sometimes in bands, small or large, sometimes minute or absent. Teeth on palate present or absent. Generally two dorsals, the first consisting of rather weak spines, the second of a few spines and devided rays. Anal generally similar to second dorsal, sometimes rudimentary. Detached finlets behind second dorsal and behind anal often present. Caudal generally well developed, seldom wanting. Pectoral arch attached to the cranium by a forked post-temporal; pterygials more or less regularly hourglass-shaped, 4 in number, 3 of them attached to the scapula. Ventrals with one spine and 5 soft rays or variously reduced, thoracic or subthoracic in position, the pelvic bones attached to the clavicles. Pseudobranchiae present.

Key to the Indo-Australian families of Scombroidea

A. Premaxillaries and nasals not forming a rostrum. One anal, with or without finlets behind it.

- *a.* Very elongate, much compressed, bandlike. Ventrals absent or reduced to a pair of scale-like appendages. Anal consisting of numerous small spines. Caudal small or wanting . . . . 1. *Trichiuridae* p. 188.
- *b.* Compressed, oblong or elongate. Ventrals present or absent. Caudal fin-rays not deeply forked at the base, the hypural in great part exposed. Finlets behind dorsal and anal present or absent . . . . . . 2. *Gempylidae* p 197.

c. Body fusiform. Ventrals with a spine and 5 rays. Caudal fin-rays deeply forked at base, covering the hypural quite or nearly. Finlets behind dorsal and anal present . . . . 3. *Scomberidae* p. 204.

B. Premaxillaries and nasals forming a rostrum. Two dorsals and two anals, no finlets behind them. Caudal fin-rays deeply forked at base, nearly or quite covering hypurals . . . . 4. *Histiophoridae* p. 230.

1. Family TRICHIURIDAE

Very elongate, much compressed. Maxillary sheathed by the preorbital. Spinous dorsal, if distinct, not longer than the soft. Anal consisting of numerous short spines. Ventrals reduced to a pair of scale-like appendages, or absent. Caudal small or absent. Pelvic bones, if present, united to form a slender bone connected with the cleithra by a long filament. Vertebrae 100 (43 + 57) or more. Ribs feeble, sessile.

Key to the Indo-Australian genera of Trichiuridae

a. Caudal present . . . . 1. *Lepidopus* p. 188.
b. No caudal . . . . 2. *Trichiurus* p. 189.

Lepidopus Gouan

(Gouan, Hist. Poissons, 1770, p. 185)

Body very elongate, band-like. Cleft of the mouth wide. No scales. Strong teeth in the jaws, the anterior ones fang-like. Minute teeth on the palatines. One single dorsal along the whole back. Anal consisting of numerous spines, more or less hidden in the skin. Caudal present. Ventrals reduced to a pair of scales.

Distribution. Atlantic, Mediterranean, Indic, and Pacific.

1. **Lepidopus tenuis** Gthr.

Lepidopus tenuis Günther, Ann. Mag. Nat. Hist. (4) XX, 1877, p. 437. — Challenger Exp. Zoology XXII, 1887, p. 37. — ibid. XXXI, II, 1889, p. 7.
Benthodesmus tenuis Goode and Bean, Oceanic Ichthyol. 1896, p. 206.
Lepidopus tenuis Brauer, Valdivia Exp. XV, 1906, p. 293.
Lepidopus tenuis Franz, Abh. Bay. Akad. IV, Suppl. Bd. 1. Abh. 1910, p. 56.
Lepidopus tenuis M. Weber, Siboga Exp. Fische, 1913, p. 405.
Lepidopus tenuis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 136.

D. 125-126. A. 73. P. 12.

Height 25 in length with caudal. Head 7 in length with caudal. Eye 7.1, 2.9 in snout. Interorbital space flat, four fifths of eye. Length of caudal about 6 in head. Lower jaw much prominent. Maxillary reaching to below anterior half of eye. Large fangs anteriorly in upper jaw. A single series of large pointed teeth in both jaws. Origin of dorsal about above hindborder of preopercle. Distance of origin of anal from tip of snout 1.18 in its distance from tip of caudal. Pectorals one third of distance between tip of snout and hindborder of opercle. In the specimen examined I find no traces of ventrals. Colour silvery. Inside of mouth blackish. Length 800 mm.

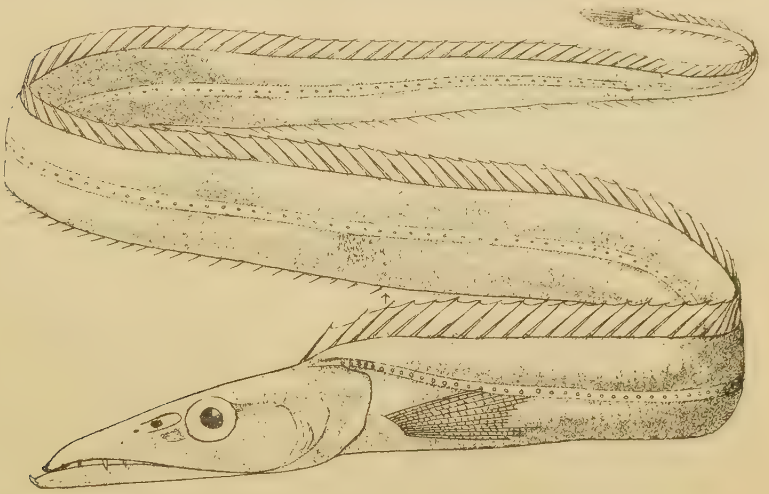

Fig. 30. *Lepidopus tenuis* Gthr. × 2/3.

Habitat: Between Kei Islands, 560 M! — Indic: Off North East Coast of Africa, Pacific: Off Japan, between Sandwich Islands and Tahiti?

2. **Trichiurus** Linné

(Linné, Syst. Naturae Ed. 10. 1758, p. 246)

Body very elongate, band-like, tail tapering to a point. No scales. Cleft of mouth wide. Strong teeth in the jaws; teeth on the palatines, none on the vomer. One single dorsal along the whole back. Anal spines numerous, minute, the first one sometimes somewhat longer, hidden beneath the skin. Ventrals absent or present as small winged spines. No caudal.

Distribution. Tropical and subtropical parts of Atlantic, Indic, and Pacific.

Note. In some of his papers Bleeker uses the name *Enchelyopus* for this genus. He borrowed this name probably from Klein (non binomical).

Key to the Indo-Australian species of Trichiurus

A. The distance between the lateral line and the ventral profile at anus much less than twice in its distance from base of dorsal. Ventrals very small, scale-like.
  a. Origin of anal below 31st to 33rd dorsal rays . . . . 1. *T. glossodon* p. 190
  b. Origin of anal below 38th dorsal ray . 2. *T. muticus* p. 191.
B. The distance between the lateral line and the ventral profile at anus much more than twice in its distance from base of dorsal. No ventrals.
  a. First anal spine well developed, more than half diameter of eye . . . . 3. *T. savala* p. 193.
  b. First anal spine minute, not longer than following ones.
    1. Height 12.9-15.8. Eye 5.8-6.6. Pectoral nearly as long as snout. Fangs barbed 4. *T. haumela* p. 194.
    2. Height 19. Eye 5.5. Pectoral much shorter than snout. Fangs not barbed 5. *T. auriga* p. 196.

1. **Trichiurus glossodon** Blkr.

Trichiurus savala Bleeker, Verh. Bat. Gen. XXIV. 1852. Makreel. p. 41 (pro parte).
Trichiurus glossodon Bleeker, Acta Soc. Indo-Neerl. VIII, 1860. Dertiende Bijdr. Vischf. Borneo, p. 38.

D. 115-120. A. about 90. P. 12. V. 1.

Height 13.9-16.8. Head 8.3-8.7. Eye 6.1-7.8, 2.3-3.3 in snout. Interorbital space less than eye, convex. Postocular part of head with a strongly compressed crest, hence the profile of the head with a concavity above eye. Maxillary reaching to below front-border of eye. Fangs in upper jaw somewhat barbed. Tongue rough or with small teeth. Origin of dorsal in vertical halfway between hindborder of eye and hindborder of preopercle. Longest dorsal rays equal to length of snout. Anal spines very short, hidden below the skin. A minute scaly appendage behind anus. Origin of anal below 31st-33rd dorsal rays. Pectorals slightly less than snout, more than twice diameter of eye. Each ventral a minute winged spine, situated nearly midway between point of snout and origin of anal. The distance between the lateral line and the ventral profile at anus much less than twice in its distance from base of dorsal. Colour of preserved specimens silvery. Fins hyaline. Length 456 mm. (Specimens of Bleeker's collection in the Leiden Museum seen by me).

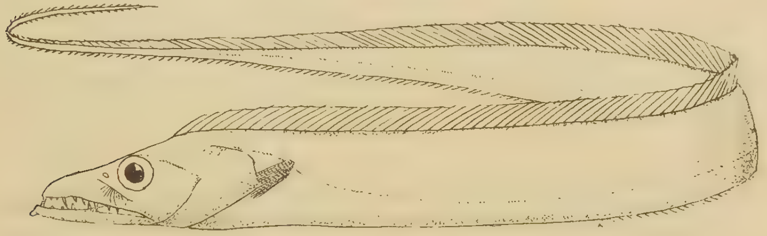

Fig. 31. *Trichiurus haumela* (Forsk.). n. s.

Habitat: Singapore!; Sumatra (Deli!, Bagan Si Api Api!, Palembang, Priaman); Bintang; Java (Jacarta, Bantam, Cheribon!, Semarang!, Surabaya!, Pasuruan); Borneo (Banjermassin, Kahajan, Sinkawang, Sungi-duri, Kapuas river). In brackish and fresh water.

Note. For a discussion of this species see note at *T. muticus*, p. 192.

2. **Trichiurus muticus** Gray

Trichiurus lepturus Linné, Syst. Nat. Ed. 10. 1758, p. 246. (pro parte) [1]).
Trichiurus muticus Gray, Zoolog. Miscellany I, 1831, p. 10.
Trichiurus muticus Günther, Cat. Brit. Mus. II, 1860, p. 348.
Enchelyopus muticus Bleeker, Ned. Tijdschr. Dierk. IV (1871) 1872, p. 131.
Trichiurus muticus Day, Fishes of India, Part II, 1876, p. 200.
?*Trichiurus muticus* Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 557.
Trichiurus muticus Fowler, Hongkong Naturalist VII, 1936, p. 77.
Trichiurus muticus Lin, Bull. Chekiang Prov. Fish. Exp. Station II, N° 5, 1936, p. 6.
Trichiurus muticus Blegvad, Fishes Iranian Gulf. Danish Sc. Inv. Iran, Part III, 1944, p. 158.

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1) See Lönnberg, Bih. Svenska Akad. XXII, 1896, N° 1, p. 40.

D. 144-149. A about 100. P. 13. V. 1.

Height 15.6-16.5. Head 10.2-10.9. Eye 6.8-7.1, 2.5-2.8 in snout. Interorbital space less than eye, convex. Postocular part of head with a strongly compressed crest, hence the profile of the head with a concavity above eye. Maxillary reaching to below frontborder of eye. Fangs in upper jaw somewhat hastate. Tongue slightly rough. Origin of dorsal in vertical between hindborder of eye and hindborder of preopercle. Longest dorsal rays equal to length of snout. Anal spines very short, hidden below the skin. Origin of anal below 38th dorsal ray. Pectorals less than snout, about twice diameter of eye. Ventrals scale-like, consisting of a winged spine, situated half way between point of snout and origin of anal. The distance between the lateral line and the ventral profile at anus much less than twice in its distance from base of dorsal. Colour of preserved specimen silvery. Fins hyaline. According to Day and to Delsman the colour is "burnished silver". Length 625 mm.

Habitat: Sumatra (Bagan Si Api Api!); Borneo (Serawak)?. — Iranian Gulf, Coasts of India, Siam, and China. In sea and brackish water.

Note. This species was unknown to Bleeker from the Indo-Australian Archipelago. He only mentions it from China, but apparently he has never seen it, otherwise he would certainly have compared it with *glossodon*. However, when describing lastnamed species, Bleeker says that it may be identical with *intermedius* Gray, and this species is generally considered to be a synonym of *muticus*. The two species *glossodon* and *muticus* are certainly very nearly related. Delsman who studied the larvae of *Trichiurus* occuring in the Java Sea (Treubia IX, Livr. 4, 1926, p. 338) distinguishes the two species by the number of vertebrae. According to him *T. muticus* has 40 + 115 = 155 and *glossodon* 30 + 131 = 161 vertebrae. As in many specimens in collections the tail is broken, the relation between length of trunk and length of tail is not always calculable. Therefore I have used the position of the anus or the origin of the anal. In all specimens from the Indo-Australian Archipelago examined I find that the origin of the anal is situated below the 31st-33rd dorsal rays, but in two specimens from Bagan Si Api Api the origin of the anal lies below the 38th dorsal ray. These specimens have more dorsal rays than the others, which I refer to *glossodon*. Bleeker gives for lastnamed species about 110 dorsal rays plus some inconspicuous ones, and *muticus* is said to have 140-150 rays (Day, Günther). For these reasons I refer the two specimens from Bagan Si Api Api to *muticus* and they are those described above. Delsman gives another characteristic to distinguish the two species. He says that *glossodon* is "easy to recognise by its purely silvery colour" and that the colour of *muticus* is "rightly characterized by Day as "burnished silver". My specimens which had been preserved in formaline do not differ in colour from specimens of *glossodon,* collected in the same locality and preserved in the same jar. Vinciguerra, l.c., says that he did not find ventrals in his specimens. I am therefore in doubt if they really belong to *muticus*.

3. **Trichiurus savala** Cuv.

Trichiurus savala Cuvier, Règne Animal II, 2. édit. 1829, p. 219.
Trichiurus savala Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p 251.
Trichiurus armatus Gray, Zool. Misc. I, 1831, p. 9.
Trichiurus savala Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1097.
Trichiurus savala Bleeker, Verh. Bat. Gen. XXIV. 1852. Makreel. p. 41.
Trichiurus savala Bleeker, Acta Soc. Indo-Neerl. VIII. 1860. Dertiende Bijdr. Vischf. Borneo, p. 32.
Trichiurus Roelandti, Bleeker, ibid. p. 35.
Trichiurus savala Günther, Cat. Brit. Mus. II, 1860, p. 347.
Enchelyopus savala Bleeker, Versl. Akad. Amsterdam (2) II, 1868, p. 292.
Lepturus savala Bleeker, Enumer. poissons Madagascar in: Rech. fauna Madagascar, Pollen & van Dam IV, 1878, p. 100.
Trichiurus savala Day, Fishes of India, Part II, 1876, p. 201.
Trichiurus savala Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 158.
Trichiurus savala Fowler, Proc. Acad. Nat. Sc. Philadelphia LVI (1904) 1905, p. 770. — ibid. LVII, 1905, p. 499.
?*Trichiurus savala* Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 557.
Trichiurus savala Hora, Mem. Asiat. Soc. Bengal VI, 1924, p. 483.
Trichiurus savala Fowler, Journ. Bombay Nat. Hist. Soc. XXXIII, 1928, p. 109. — Hongkong Naturalist VII, 1936, p. 77.
Trichiurus savala Lin, Bull. Chekiang Prov. Fish. Exp. Station II, N° 5, 1936, p. 5.

D. 105-134. A. 72-80. P. 11-12. V. 0.

Height 14.8-19.8. Head 7.4-10.5. Eye 6.7-10, 2-3.5 in snout, and 1-1.2 in the flat interorbital space. Upper profile of head straight. Maxillary reaching below frontborder of eye in small specimens, below hindborder of eye in large ones. Fangs in both jaws barbed. Tongue smooth. Origin of dorsal above hindborder of preopercle. Longest dorsal rays equal to snout. First anal spine well developed, more than half diameter of eye, following spines small but well visible. Origin of anal below 40th-43rd dorsal rays. No ventrals. Pectorals as long as snout or in large specimens one half diameter of eye longer. The distance between the lateral line and the ventral profile at anus much more than twice in its distance from base of dorsal. Colour of preserved specimens silvery. Head brownish above. Dorsal and pectorals yellowish, with a rather broad black terminal border, less distinct in small specimens. Length 990 mm.

Nom. indig. Bamban (Balikpapan); Tima-tima (Bagan Si Api Api).

Habitat: Singapore; Riouw; Bintang; Banka; Sumatra (Deli!, Bagan Si Api Api!, Priaman, Palembang); Java (Jacarta, Tanare); Bali; Sumbawa; Borneo (Sandakan, Sarawak, Kapuas, Pamangkat, Singkawang, Kahajan, Sungi-duri!, Koemai!, Bandjermassin?, Balikpapan!). — Réunion, Coasts of India, Andamans, Siam, Malaya, China, Japan, Philippines, North Australia. In sea and estuaries.

Note. I have united *T. roelandti* Blkr. with *savala*. I have examined the type in the Leiden Museum and I have seen specimens in the Amsterdam Museum which agree with Bleeker's description of *roelandti*. They are all large specimens, 700-990 mm long, and I am convinced that the characteristics which Bleeker mentions: the relatively shorter head, smaller eyes, longer tail, maxillary reaching to below hindborder of eye, are due to age.

4. **Trichiurus haumela** (Forsk.). (Fig. 31, p. 191).

Clupea haumela Forskål, Descr. Animal. 1775, p. 72.
Trichiurus hamrela Bloch Schneider, Syst. Ichth. 1801, p. 518 (errore).
Trichiurus haumela Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 249.
Trichiurus haumela Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1097.
Trichiurus haumela Bleeker, Verh. Bat. Gen. XXIV, 1852, Makreel. p. 41.
Trichiurus lajor Bleeker, Nat. Tijdschr. Ned. Indië VII, 1854, p. 248. — Acta Soc. Indo-Neerl. VIII, 1860, Dertiende Bijdr. Vischf. Borneo. p. 33.
Trichiurus haumela Günther, Cat. Brit. Mus. II, 1860, p. 348.
Enchelyopus haumela Bleeker, Versl. Akad. Amsterdam XIV, 1862, p. 109.
Trichiurus haumela Kner, Novara Exp. Fische I, 1865-1867, p. 140.
Trichiurus lajor Kner, ibid. p. 141.
Trichiurus haumela Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 471.
Trichiurus haumela Day, Fishes of India, Part II, 1876, p. 201.
Trichiurus haumela Steindachner & Döderlein, Denkschr. Akad. Wien XLVIII, 1883, p. 35.
Trichiurus haumela Klunzinger, Fische des rothen Meeres I, 1884, p. 120, p. 121.

Trichiurus haumela Vinciguerra, Ann. Mus. Civ. Genova (2) IX, 1890, p. 170.
Trichiurus haumela Steindachner, Denkschr. Akad. Wien LXXI, 1902, p. 142.
Trichiurus haumela Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII, Part 4, 1904, p. 506. — Proc. Acad. Nat. Sc. Philadelphia LVI (1904) 1905, p. 771.
Trichiurus haumela Evermann & Seale, Bull. Bur. Fish. XXV (1906) 1907, p. 62.
Trichiurus haumela Jordan & Richardson, ibid. XXVII (1907) 1908, p. 251. — Mem. Carnegie Mus. IV, N° 4, 1909, p. 180.
Trichiurus haumela Bean & Weed, Proc. U. S. Nat. Mus. XLII, 1912, p. 603.
Trichiurus haumela Ogilby, Mem. Queensl. Mus. II, 1913, p. 91.
Trichiurus haumela M. Weber, Siboga Exp. Fische, 1913, p. 406.
Trichiurus haumela Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 792.
Trichiurus haumela Fowler & Bean, Proc. U. S. Nat. Mus. LXXI, Art. 10, 1927, p. 5.
Trichiurus haumela Fowler Mem. B. P. Bishop Mus. X, 1928, p. 135.
Trichiurus haumela Giltay, Mem. Mus. Roy. Hist. Nat. V, 1933, p. 84.
Trichiurus haumela Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 71. — ibid. LXXXVII, 1935, p. 138. — Hongkong Naturalist VII, 1936, p. 78. — ibid. Suppl. 1938, p. 19.

D. about 130. A. about 75-80. P. 11. V. 0.

Height 12.9-15.8. Head 6.8-7.6. Eye 5.8-6.6, 2-2.25 in snout, and equal to or somewhat less than the flat or slightly concave interorbital space. Maxillary reaching to below frontborder of pupil or nearly so. Fangs in both jaws barbed. Tongue smooth. Origin or dorsal above hindborder of preopercle. Longest dorsal rays as long as snout. First anal spine small, less than diameter of pupil, following spines minute. Origin of anal below 40th dorsal ray. No ventrals. Pectorals nearly as long as snout. The distance between the lateral line and the ventral profile at anus much more than twice in its distance from base of dorsal. Colour of preserved specimens silvery. Dorsal and pectorals light yellowish, the dorsal blackish anteriorly and along its upper border, the pectorals sometimes dusky. Length over 1000 mm.

Habitat: Singapore; Riouw; Nias!; Sumatra (Telokbetong, Benkulen, Banjuasin, Padang, Tiku, Priaman, Deli!); Banka; Java (Jacarta!, Anjer, Tjiringin, Tegal, Cheribon!, Samarang, Rembang, Surabaya, Pasuruan, Batu Ulo!); Bawean!; Borneo (Pamangkat, Sinkawang, Sandakan); Madura; Bali; Lombok!; Flores!; Celebes (Makassar!, Badjoa, Menado); Batjan; Halmahera; Obi; Ceram!; Ambon!; Waigeu; New Guinea (Merauke!). — East Coast of Africa, Red Sea, Arabian Sea, Coasts of India, Ceylon, Andamans, Siam, China, Japan, Riu Kiu Islands, Formosa, Philippines, Islands in Torres Strait, Queensland.

In sea and estuaries. Kner (l.c.) mentions a specimen caught in open sea, 50 miles off Ceylon. Delsman (Treubia IX, Livr. 4. 1926, p. 338) who studied eggs and larvae of this and other species of *Trichiurus* tells us that at certain periods, especially at the beginning of the East mossoon, this species approaches the coast in dense crowds, and frequents quite shallow water for some time. After a few days they disappear as suddenly as they appeared.

Note. I have examined the typical specimens of *T. lajor* from Bleeker's collections in the Leiden Museum. I cannot distinguish it from young *haumela,* and I have therefore united *lajor* with *haumela.* Max Weber (l.c.) already suggested the identity of these two species.

Trichiurus japonicus Schl., a rather common species from the coasts of China and Japan, has been recorded from Singapore by Steindachner (Sitzber. Akad. Wien LX, 1869, p. 563) and by Borodin (Bul. Vanderbilt Mar. Mus. I. art. 12, 1930, p. 49) from the Philippines. Recent authors such as P. J. Schmidt (Trans. Pacific Comm. Acad. Sc. U.S.S.R. II, 1931, p. 42) and Lin (Bull. Chekiang Prov. Fish. Exp. Station II, N° 5, 1936, p. 2) think it possible that *japonicus* is identical with *haumela.* Fowler (Hongkong Naturalist VII, 1936, p. 77) distinguishes the two species as follows:

Eye 2 to $2^{1}/_{3}$ in snout, depth 14-18 . . . . . . *T. haumela.*
Eye $2^{1}/_{2}$ in snout, depth $18\frac{1}{5}$-$18\frac{4}{5}$ . . . . *T. japonicus.*

These indeed are small differences, and only the examination of a large material from many localities will show if these differences are due to variability inside the species, or to the existence of two species or perhaps geographical races.

5. **Trichiurus auriga** Klz.

Trichiurus auriga Klunzinger, Fische des rothen Meeres, 1884, p. 120, p. 121.
Trichiurus auriga M. Weber, Siboga Exp. Fische, 1913, p. 406.

D. about 120. A about 65. P. 10. V. 0.

Height 19, head 7.3. Eye 5.5, 1.7 in snout, and more than flat interorbital space. Maxillary reaching to below frontborder of pupil. Fangs not barbed. Origin of dorsal above hindborder of preopercle. Longest dorsal rays somewhat longer than snout. Anal spines minute, the anterior ones hidden in the skin. Origin of anal about below the 38th dorsal ray. No ventrals. Pectorals much shorter than snout, twice in postorbital part of head. The distance between the lateral line and the ventral profile at anus much more than twice in its distance from base of dorsal. Colour of preserved specimen silvery. Dorsal and pectorals whitish. Length 320 mm.

Habitat: Timor Sea!. — Red Sea.

Note. Klunzinger described this species from a single specimen, long 250 mm, and captured in the Red Sea. As far as I know this species has never been mentioned in literature again, excepting M. Weber l.c., who described a specimen from the Timor Sea. Weber's specimen, which I redescribe here, agrees in most points which that of Klunzinger. *T. auriga* seems to be very closely related to *T. haumela,* differing by its lesser height, comparatively larger eye, smaller pectorals, and by the absence of barbs on the fangs.

2. Family GEMPYLIDAE

Oblong or elongate, compressed. Maxillary exposed. Two dorsals, the first spinous and longer than the second. Anal similar to soft dorsal. Ventrals well developed, with a spine and 5 rays, reduced to a spine only or rudimentary. Pelvic bones separate, anteriorly extending forward to the cleithra and firmly imbedded in the ligament between them. Vertebrae 31 (25 + 6) to 53 (28 + 25). Anterior precaudals without parapophyses, with sessile ribs; posterior precaudals with ribs attached at the extremities of closed haemal arches; epipleurals attached to the centra.

Key to the Indo-Australian genera of Gempylidae

1. Lateral line present, body scaly or naked, but not covered with bony dermal protuberances.
    a. Much elongate. Height about 20. D^1. XXX. Six finlets . . . . 1. *Gempylus* p. 198.
    b. Less elongate. Height much less than 20. D^1. XVIII-XX.
        a^1. Ventrals well developed, with a spine and 5 rays. Six finlets . . . . 2. *Thyrsites* p. 199.
        b^1. Ventrals rudimentary or absent. Two or three finlets . . . . 3. *Rexea* p. 201.
2. Lateral line indistinct. Body covered with dermal bony protuberances, each terminating in several spines. Ventrals with a spine and 5 rays. Two finlets . . . . 4. *Ruvettus* p. 203.

1. **Gempylus** Cuvier

(Cuvier, Règne Animal, ed. 2. II. 1829, p. 200)

Lemnisoma Lesson, Voyage Coquille. Zool. II. 1. Partie, 1830, p. 160.

Body very much elongate, compressed. Head long, pointed anteriorly, the lower jaw with a callous projection. No scales, excepting some deciduous ones behind eye. Pointed compressed teeth in the jaws, some large compressed canines anteriorly in the upper jaw. No teeth on palate. Origin of first dorsal slightly before gill opening, consisting of XXX flexible spines. Second dorsal similar to anal, falcate. Six detached finlets behind dorsal and anal. Ventrals rudimentary, consisting of a spine and a few rays. Caudal forked. Gill membranes free from each other and from isthmus. Lateral line running in middle of sides.

Distribution that of the single species known.

1. **Gempylus serpens** C. (Fig. 32, p. 199)

Gempylus serpens Cuvier, Règne Animal 2. ed. II, 1829, p. 200.
Gempylus serpens Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 207.
Gempylus coluber Cuvier & Valenciennes, ibid. p. 211.
Lemnisoma thyrsoides Lesson, Voyage Coquille. Zool. II. 1. Partie, 1830, p. 160.
Gempylus serpens Günther, Cat. Brit. Mus. II, 1860, p. 352. — Fische der Südsee I, 1873-1875, p. 106.
Gempylus serpens Goode & Bean, Oceanic Ichthyol. 1895, p. 202.
Lemnisoma thryristoides Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, p. 179.
Gempylus coluber Franz, Abh. Bayer. Akad. Wiss. IV. Suppl. Bd. 1. Abd. 1910, p. 57.
Gempylus serpens Waite, Rec. Cant. Mus. II. Part 1. 1913, p. 20.
Gempylus serpens Fowler, Mem.. B. P. Bishop Mus. X, 1928, p. 135. — Hongkong Naturalist VII, 1936, p. 75.

D^1. XXX. D^2. 13. + 6. A. 11. + 6. P. 14. V. I. 2.

Height 20, 22.2 in length with caudal. Head 5, 5.5 in length with caudal. Eye 6.1, 2.8 in snout. Interorbital space somewhat less than eye, flat with a median longitudinal groove. Teeth in upper jaw longer than those in the lower jaw. A few large, compressed and slightly serrated canines anteriorly in the upper jaw. Origin of dorsal slightly before gill opening. Second dorsal and anal falcate, the longest rays of second dorsal 1.5 eye diameters. Origin of anal below that of second dorsal. Pectorals falcate. Ventrals very short, less than half eye, their origin half eye diameter behind that of pectorals. Caudal deeply forked. Colour of preserved specimen brown. Description made after the single specimen known from the Indo-Australian Archipelago, long 445 mm. The species attains a length of 1000 mm.

Habitat: Between Taliabu and Buru! — Tropical and subtropical parts of Atlantic, Indic, and Pacific, but apparently everywhere rare.

It is said to be a deep sea fish, but without proof. As far as I know no specimen has ever been caught in great depths, but there are several records of captures at the surface of the sea.

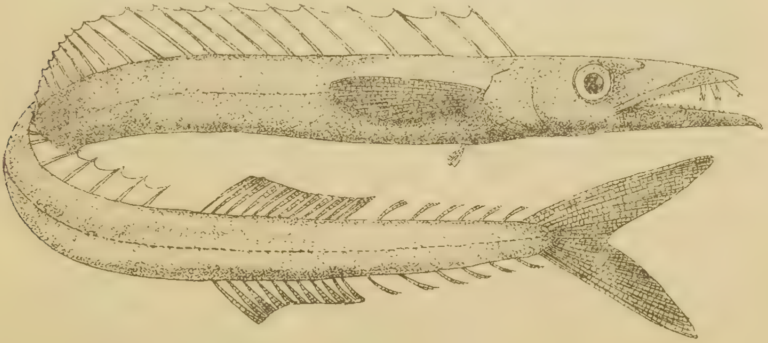

Fig. 32. *Gempylus serpens* C. × 1/2.

2. **Thyrsites** Cuvier & Valenciennes

(Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 196)

Elongate. Body and sides of head behind eye with small cycloid deciduous scales. Mouth large. A single row of strong teeth in both jaws and some large canines in front. Teeth on palatines in a single row. Vomer edentulous. Two contiguous dorsals, the first consisting of XX spines, the second with two simple and ten branched rays. Anal with one simple and 10-11 branched rays, similar to second dorsal. Six detached finlets behind dorsal and anal. Pectorals small, somewhat pointed. Ventrals short with 1 spine and 5 rays. Caudal forked. Lateral line single, descending abruptly below the posterior part of the spinous dorsal. Gill membranes free from each other and from isthmus. Pseudobranchiae well developed.

Distribution: One or a few species with a circum-antarctic distribution.

1. **Thyrsites atun** (Euphr.)

Scomber atun Euphrasen, Vetensk. Acad. Nya Handl. XII, 1791, p. 315.
Thyrsites atun Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 196.
Thyrsites altivelis Richardson, Proc. Zool. Soc. London VII, 1839, p. 99. — Ann. Mag. Nat. Hist. XI, 1843, p. 23.
Thyrsites atun, var. *altivelis* Richardson, Trans. Zool. Soc. London III, part I, 1840, p. 119.
Lucoscombrus atun van der Hoeven, Handboek der Dierk. II, 1855, p. 368.
Thyrsites atun Günther, Cat. Brit. Mus. II, 1860, p. 350.
Thyrsites atun Bleeker, Nat. Tijdschr. Ned. Indië XXI, 1860, p. 68.
Thyrsites atun Hutton, Fishes of New Zealand, 1872, p. 13.
Thyrsites atun Klunzinger, Sitzber. Akad. Wien 1880, p. 375.
Thyrsites atun Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 159.
Thyrsites atun M. Weber, Siboga Exp. Fische, 1913, p. 407.
Thyrsites atun McCulloch, Rec. Austr. Mus. XIII, N° 4, 1921, p. 139.
Thyrsites atun Waite, Rec. South Austr. Mus. II, N° 1, 1921, p. 144.
Thyrsites atun McCulloch, Austr. Zoologist II, Part III, 1922, p. 107.
Thyrsites atun Barnard, Ann. South Afric. Mus. XXI, Part II, 1927, p. 788.
Thyrsites atun Whitley, Rec. Austr. Mus. XVIII, N° 4, 1931, p. 151.
Thyrsites atun Norman, Discovery Rep. XVI, 1937, p. 96.

D^1. XX. D^2. 2. 10 + 6. A. 1. 11 + 6. P. 2. 12. V. I. 5.

Height 7.1, 8.4 in length with caudal. Head 3.7, 8.4 in length with caudal. Eye 7.4, 3.4 in pointed snout and 1.7 in interorbital space, which is flat, but the eyes are situated well above the dorsal profile. Lower jaw prominent. Maxillary reaching slightly behind vertical through frontborder of eye. Dorsal spines slender but stiff, the anterior ones about twice eye, the spines decreasing in length posteriorly, the last one about two thirds of eye; second dorsal and anal falcate, the anterior rays about twice eye, the last ray equal to half eye. Origin of anal slightly behind that of second dorsal. Pectorals one eye diameter shorter than snout. Ventrals slightly longer than eye, their origin slightly behind that of pectorals. Caudal deeply forked. Colour of preserved specimen bluish brown above, lighter below. Membrane of first dorsal black, the spines white. Other fins yellowish brown. Length of specimen described 955 mm.

Habitat: Terawangan (Noord Island); Celebes (Makassar!); Buru! — South Africa, Tristan da Cunha, Argentina, Patagonian-Falklands region, Chile, Australia, Tasmania, New Zealand. In sea.

3. **Rexea** Waite

(Waite, Proc. New Zeland Inst. 1910, Part 2, Jan. 1911, p. 49)

Jordanidia Snyder, Proc. U. S. Nat. Mus. XL, May 1911, p. 527.

Rather elongate, fusiform. Scales small, cycloid, deciduous. Mouth large, with a single row of dagger-like teeth in each jaw and some large canines in front. Teeth on palatines in a single row. No teeth on vomer. Two contiguous dorsals, the first consisting of XVII-XVIII spines, the second with II spines and 13-15 rays. Anal with II spines and 11-14 rays, similar to second dorsal. Two detached finlets behind dorsal and anal each. Pectorals rounded. Ventrals rudimentary, consisting of I-IV minute flexible spines or altogether wanting. Caudal forked. Lateral line extending from upper edge of gill opening along sides near to the dorsal profile to below middle or end of second dorsal, with a downward branch originating below base of 5th-6th dorsal spines, descending suddenly to the median line of the body, thence in a horizontal direction to base of caudal. Pseudobranchiae present.

Distribution. A few species from the Indic and the Pacific.

Note. McCulloch (Biol. Res. Endeavour III, 1915, p. 150) was the first to unite the genera *Rexea* and *Jordanidia,* and discussed them at length. Whitley (Rec. Austr. Mus. XVII, N° 3, 1929, p. 119) proved that *Rexea* has date priority above *Jordanidia.* M. Weber (Siboga Exp. Fische, 1913, p. 404) followed Jordan & Evermann (Fishes of North and Middle America, Part I, 1896, p. 882, footnote) in using the name *Dicrotus* Günther (Cat. Brit. Mus. II, 1860, p.349) for this genus. *Dicrotus* was based on a specimen in a juvenile stage, without finlets, with long ventral spines and the preopercle denticulated. These features are known to characterize the young Gempylidae, but *Dicrotus* has a single lateral line and it is not proved that the missing branch develops later. I think it therefore more probable that *Dicrotus* is the young stage of *Promethichthys.*

1. **Rexea prometheoïdes** (Blkr.) (Fig. 33, p. 202)

Thyrsites prometheoïdes Bleeker, Acta Soc. Sc. Indo-Neerl. I, 1856. Beschr. vischs. Amboina p. 42.

Thyrsites bengalensis Alcock, Journ. Asiat. Soc. Bengal LXIII, 1894, p. 117. —ibid. LXV, 1896, p. 315.

Thyrisites (Promethichthys) bengalensis Alcock, Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 42.

Rexea prometheoïdes Waite, Rec. Canterbury Mus. I, N° 3, 1911, p. 235.
Dicrotus prometheoïdes M. Weber, Siboga Exp. Fische, 1913, p. 404.

D¹. XVIII. D². II. 13 + 2. A. II. 11 + 2. P. 15. V. I.

Height 6.25, 7 in length with caudal. Head 3, 3.38 in length with caudal. Eye 4, 1.5 in snout. Interorbital space concave, 1.5 in eye. Mouth somewhat oblique. Maxillary almost reaching to below front-border of pupil. Lower jaw prominent, the two anterior canines in the lower jaw remain outside the mouth, when lastnamed is closed. Anterior fangs in the upper jaw somewhat curved, much longer than those of the lower jaw. Origin of first dorsal slightly behind hindborder of preopercle. Anterior and posterior spines of first dorsal somewhat shorter than the median ones, the length of which barely exceeds eye in length. Second dorsal originating close to end of first dorsal, the anterior rays longest, almost equal to eye. Origin of anal slightly behind that of second dorsal; the first spine of anal minute, separated from the rest of the fin. Pectorals with a narrow base, pointed, slightly longer than snout and half eye. Ventrals minute rudiments, in front of base of pectorals. Caudal deeply forked. Colour of preserved specimen silvery, back brownish. Fins whitish hyaline. A black blotch superiorly between the first to third spines of first dorsal. Pectorals dusky in their distal half. Length 173 mm.

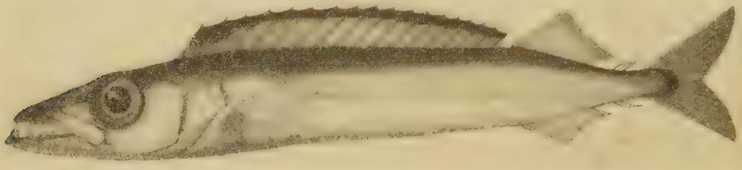

Fig. 33. *Rexea prometheoïdes* (Blkr.). × ⁵/₈.

Habitat: Makassar Straits, 400 M.!; Sangi Islands; Ambon. — Bay of Bengal, 265-457 M., New Zealand.

Note. Kamohara (Annot. Zool. Japon. XVII, N° 1, 1938, p. 50) united *Jordanidia raptoria* Snyder with this species, but in *raptoria* the ventrals are absent. It is possible that this difference is of no importance, as according to McCulloch (l.c.) the ventrals may be developed in *Rexea solandri* (C.V.) as 4 weak spines or may be reduced to "an indistinct scale-like structure". As long as the variations of this rudimentary fin are not clear, I think it safer to keep the species apart.

4. **Ruvettus** Cocco

(Cocco, Giorn. Sc. Sicilia XLII, 1833, p. 2)

Acanthoderma Contraine, Journ. Ac. Sc. Bruxelles X, 1835, p. 1.
Aplurus Lowe, Trans. Zool. Soc. London II, 1841, p. 180.

Moderately elongate, fusiform. Body and sides of head behind eye covered with minute cycloid scales and with bony tubercles, remote from each other, arranged in longitudinal rows, each tubercle provided with 2 or more spines, pointed in caudal direction. Mouth large. A single series of strong teeth in both jaws and on palatines. Strong canines in front of jaws. Two dorsals, the first consisting of XIII-XV slender spines, the second dorsal with 15-18 rays. Anal originating slightly behind second dorsal, with 15-18 rays. Two detached finlets behind dorsal and behind anal. Pectorals moderate, more or less rounded. Ventrals well developed with I spine and 5 rays. Caudal deeply emarginate. Belly keeled. Lateral line scarcely indicated.

Distribution. Two species growing to a large size, from deep water in Atlantic, Mediterranean, Indic, and Pacific.

Note. The oil of these fishes acts as a very rapid and powerful purgative.

1. **Ruvettus tydemani** M. Web. (Fig. 34, p. 204).

?*Ruvettus pretiosus* Steindachner & Döderlein, Denkschr. Akad. Wien XLVIII, 1883, p. 37.
Ruvettus pretiosus Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, p. 177 (nec Cocco).
?*Ruvettus pretiosus* Franz, Abh. K. Bayer. Akad. Wiss. Suppl. Bd. IV. Abth. 1. 1910. p. 57.
Ruvettus Tydemani M. Weber, Siboga Exp. Fische, 1913, p. 401.
Ruvettus pacificus Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 34.
Ruvettus tydemani Jordan & Hubbs, ibid. p. 221.
Ruvettus tydemani E. K. Jordan, Proc. U. S. Nat. Mus. LXVI. Art. 33. 1925, p. 14.
Ruvettus pretiosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 135 (nec Cocco).
Ruvettus pretiosus Herre, Philipp. Journ. Sc. LIX, 1936, p. 365 (nec Cocco). —Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 108 (nec Cocco).
?*Ruvettus pretiosus* Kamohara, Annot. Zool. Japon. XVII, N° 1, 1938, p. 46.
Ruvettus pretiosus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 140 (nec Cocco).

D^1. XIII. D^2. 16 + 2. A. 15 + 2. P. 2. 11. V. I. 5.

Height 5.3, 6.6 in length with caudal. Head 3.4, 4.2 in length with caudal. Eye 6.7, 2.4 in snout, and 1.6 in the interorbital space, which is convex but flattened in its median part. Posterior and anterior nostrils more than one half diameter of eye apart, the posterior one one third diameter of eye before eye. Maxillary reaching to below hindborder of eye. 85 tubercles in a longitudinal series and 38 in a transverse series. Anterior dorsal spines about as long as eye, posterior ones shorter. Second dorsal and anal elevated and falcate anteriorly, the longest rays somewhat longer than snout. Rays of the posterior half of both fins subequal, their length less than that of eye. Ventrals two thirds of pectorals, which are equal to snout and half eye. Caudal forked. Colour of preserved specimen brown, fins dark brown. Description made after the type of the species, 1400 mm long.

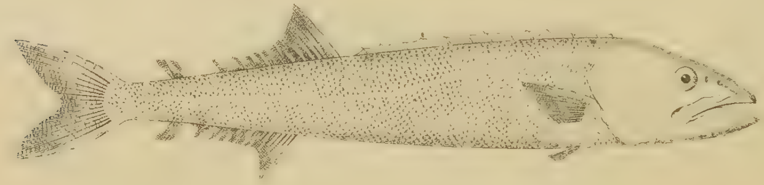

Fig. 34. *Ruvettus tydemani* M. Web. × 16.

Nomen indig.: Ikan Babi (Malay).

Habitat: Binongka, ± 250 M! — Philippines, Japan, Society Islands, Hawaii.

Note. M. Weber (l.c.) pointed out the differences between this species and the Atlantic *R. pretiosus* Cocco. I doubt if the differences in the number of dorsal and anal spines and rays holds good, but apparently the much lower number of bony tubercles in a lateral and a transverse series is a good characteristic to distinguish the Pacific form.

3. Family SCOMBRIDAE

Body fusiform. Premaxillaries beak-like, free from the nasals, which are separated by the ethmoid. Mouth rather large, teeth in jaws moderate, sometimes wanting. No true canines. Palate toothed or not. Two dorsals. Anal with I-III feeble spines. Finlets behind dorsal and anal present. Caudal forked, the rays of each lobe deeply forked at base, parallel to each other and forming an acute angle with those of the other lobe, covering the hypural nearly or quite. Pectorals placed high. Ventrals with I spine and 5 rays. Pelvic bones extending forward to the cleithra. Vertebrae 31-66. Anterior precaudals without parapophyses, with sessile ribs; posterior precaudals with ribs attached at the extremities of closed heamal arches; epipleurals on the centre.

Distribution: Cosmopolitical.

Key to the Indo-Australian genera of Scombridae

I. Scales equally covering the whole body. Two slight ridges on each side of tail. 5-7 finlets.
  A. A single lateral line.
    a. Vomer and palatines toothed 1). A stiff anal spine 1). Gill rakers moderate . . . . 1. *Scomber* p. 205.
    b. Vomer and palatines toothless. Gill rakers visible when the mouth is opened. No stiff anal spines . . . 2. *Rastrelliger* p. 209.
  B. Two lateral lines. Vomer and palatines toothed . . . . 3. *Grammatorcynus* p. 215.
II. Scales of pectoral region forming a corselet. A keel on each side of tail. 6-9 finlets.
  A. D^2 not far behind minute last spine of D^1. Teeth on palate present or absent.
    a. Body naked, excepting the corselet. 4. *Euthynnus* p. 216.
    b. Body regularly scaled . . . . . 5. *Thunnus* p. 221.
  B. D^1 and D^2 removed. No teeth on palate 6. *Auxis* p. 226.
III. Body naked or with rudimentary scales.
  A. Gill laminae reticulated. Gill rakers none. 9-10 finlets. Teeth triangular, slightly serrated . . . . 7. *Acanthocybium* p. 227.
  B. Gill laminae normal. Gill rakers present, short, and few in number. 4-10 finlets. Teeth pointed, large, seldom serrated . . . . 8. *Scomberomorus* p. 229.

1. **Scomber** Linné

(Linné, Syst. Naturae Ed. X. I. 1758, p. 297)

Fusiform, body and cheeks covered by small, thin scales. Eye with a well developed adipose eyelid. Small teeth in the jaws, on

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1) Consult, however, the description of *S. australasicus*, p. 206.

the vomer, and on the palatines. Gill rakers moderate and not visible when the mouth is opened. Two dorsals, the first consisting of spines, the second of soft rays. The first dorsal can be retracted into a sheath. Anal similar to second dorsal. The first ray generally a strong but short spine. Five or six finlets behind dorsal and anal. Caudal deeply forked. Pectorals high up, short, with a rather broad base. Ventrals with a spine and five rays.

Distribution. Pelagic fishes found in most tropical and temperate seas.

Note. Species of *Scomber* seem to be of rare occurrence in the Indo-Australian Archipelago. Bleeker only records *S. australasicus* from Ambon, apparently after Günther, and without having seen a specimen. Up to now this species is the only one found in this area, the scarce records are given below. In the collections of the Amsterdam museum there are three specimens of another species, all from Java which I refer provisionally to *S. janeseba*. We are greatly in need of a revision of the Indo-Pacific species of *Scomber* and for that of the whole genus too, but this can only be done at the hand of a very large material, and on a statistical base. Fraser-Brunner (Ann. Mag. Nat. Hist. (12) III, 1950, p. 153) recognizes but two species of *Scomber, S. scombrus* and S. *japonicus, australasicus* and *janeseba* being synonyms of the latter.

Key to the Indo-Australian species of Scomber

1. Height 4.5. D^1. IX. Ll. about 150. Anal spine
   very feeble . . . . 1. *S. australasicus* p. 206.
2. Height 5.2-5.5. D^1. X-XI. Ll. about 180. Anal
   spine short but strong . . . . 2. *S. janeseba* p. 208.

1. **Scomber australasicus** C. V. (Fig. 35, p. 207)

Scomber australasicus Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 49.
Scomber australasicus Günther, Cat. Brit. Mus. II, 1860, p. 359.
Scomber australiensis Peters, Monatsber. Akad. Berlin, 1876, p. 836 (errore?).
Scomber australasicus Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 190.
Scomber australasicus Johnston, Proc. Royal Soc. Tasmania (1882) 1883, p. 118.
Scomber australasicus de Beaufort, Bijdr. Dierk. Afl. 19, 1913, p. 133.
Scomber australasicus Mc Culloch, Austr. Zoologist II, Part III, 1922, p. 104.

D^1. IX. D^2. 12 + 5. A. 1.10 + 5. P. 2. 18. V. I. 5. Ll. about 150.

Height 4.5, 5.3 in length with caudal. Head 3.5-3.6, 4.1 in length with caudal. Eye 3.8-4.2, 1.05-1.18 in snout and equal to flat interorbital space. Scales behind gill opening and below pectoral larger than those of rest of body. Mouth somewhat oblique, maxillary reaching to below frontborder of eye. A row of about 30 straight pointed teeth in each ramus of the jaws, those of the lower jaw larger than those of the upper one. Teeth on vomer and palatines very poorly developed. Gill rakers 12-13 + 23-25; thorny, the longest about three fourths of diameter of eye. Lateral line running in a straight line from head to, and on, middle of caudal peduncle. Second dorsal spine longest, about equal to postorbital part of head; following spines rapidly decreasing in length to the seventh, the 8th and 9th minute. Second dorsal falcate, the longest rays as long as snout. Anal spine weak and flexible. Origin of anal below that of second dorsal. Pectorals equal to postorbital part of head, slightly longer than ventrals. Colour of preserved specimens dark brownish above, silvery on sides and below. Anterior part of back with light bluish sinuous stripes. Length of specimens described 91 and 132 mm.

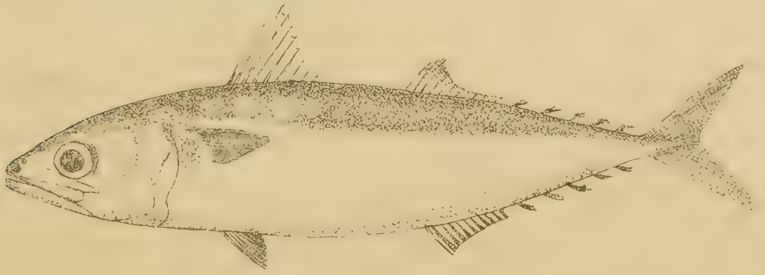

Fig. 35. *Scomber australasicus* C. V. × $^{10}/_{13}$.

Habitat: Buton!; North Celebes; Ambon; Misol. — Coasts of Australia, Tasmania, and New Zealand.

Note. My specimens differ from the descriptions of *australasicus* in having the teeth on the palate practically wanting. Some rugosities can be felt with a needle, but that is all. This combined with the very feeble anal spine, makes me doubt if they really are *australasicus* and even if they belong to the genus *Scomber*, as they are more or less intermediate between *Scomber* and *Rastrelliger*. However, they can't belong to lastnamed genus, as the gill rakers are quite Scomber-like. In other respects they agree with *australasicus,* which species has been recorded from the Indo-Australian Archipelago by Günther (l.c.) and Peters (l.c.) from Ambon; by Günther (Brenchley's Cruise of the Curaçao, 1873, p. 411) from Misol, by A. B. Meyer (Ann. Soc. Espan. Hist. Nat. XIV, 1885, p. 27) from North Celebes, and by myself (l.c.) from Buton. Fraser Brunner, who kindly examined my specimens, writes me: "I cannot find any good reason for distinguishing these from *Scomber japonicus* as defined in my recent paper".

2. **Scomber janeseba** Blkr.

Scomber pneumatophorus japonicus, var. *minor* Schlegel, Fauna Japonica, Pisces I, 1942, p. 93.
Scomber janeseba Bleeker, Nat. Tijdschr. Ned. Indië VI, 1854, p. 406. — Verh. Bat. Gen. XXVI, 1854-1857. Nieuwe Nalezingen Ichth. Japan, p. 96.
Scomber janeseba Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 442. — Fische des Rothen Meeres I, 1884, p. 110.
Scomber janeseba Day, Fishes of India, Suppl. 1888, p. 790.
?*Scomber japonicus* Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, p. 169.
Scomber japonicus Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 403 (partim).
?*Scomber chrysozonus* Fowler, Hongkong Naturalist VII, 1936, p. 63. — Ibid. Suppl. 1938, p. 18 (nec Rüppell).

D^1. X-XI. D^2. 12 + 5. A. I. 1. 10-11. + 5. P. 2. 19. V. I. 5. Ll. 180-185.

Height 5.2-5.5, 6.4 in length with caudal. Head 3.2-3.5, 3.8 in length with caudal. Eye 3.9-4.2, 1.2-1.4 in snout, and somewhat more than flat interorbital space. Mouth oblique. Maxillary reaching to below frontborder of eye. In each ramus of the jaws a row of about 30 teeth, which are slightly hooked at tip, those of the lower jaw slightly longer than those of the upper jaw. A few similar teeth is one row on the vomer, and in a row of about 10 on palatines. 22-27 gill rakers on lower branch of first arch. Lateral line gradually descending to below end of second dorsal, forming here a slightly steeper bent downwards, and then continued in a horizontal direction on caudal peduncle. First dorsal spine slightly less than second, which is longest and equal to postorbital part of head. Following spines rapidly decreasing in length, the last less than pupil. Anterior rays of second dorsal much lower than spines of first dorsal, and about equal to eye; last rays half as long, the upper border of the fin somewhat concave. First anal spine very short but rather strong, second spine half as long as anterior anal rays, which equal diameter of eye in length. Origin of anal slightly behind that of second dorsal. Pectorals slightly longer than ventrals, equal to postorbital part of head. A light patch on snout immediately before and partly between eyes. In formol specimens the back is light violet, with about 30 transverse more or less oblique indigo bars from occiput to base of caudal, more or less broken into spots below the lateral line and otherwise also very irregularly arranged, sometimes united below and forming a V, or united at both ends and forming an O. A dark bar along base of pectorals. Fins yellowish, first dorsal dusky. Length of specimens described 130 mm.

Habitat: Java (Jacarta!; Batu Ulo!). — Red Sea, Persian Gulf, Coasts of India, China, Japan, Riu Kiu Islands, Australia (Honson's Bay)?, Hawaii?.

Note. My specimens agree with Bleeker's description of *janeseba,* which species most authors consider to be the young of *japonicus.* Kishinouye (l.c.), who was in the position to examine many specimens, says that the Japanese fishermen distinguish between the larger and flatter "hirasaba" and the smaller and rounded "marusaba", but that intermediate forms occur. Bleeker's *janeseba* is based on specimens of the "marusaba". In typical "hirasaba" Kishinouye counts 9 spines in the first dorsal, in the "marusaba" 11-12. This looks as if the two differ, but Steindachner & Döderlein (Denkschr. Akad. Wien XLIX, 1884, p. 177) speaking of *S. colias* from Japan, which is possibly identical with *janeseba,* say that the last dorsal spines sometimes disappear in older specimens without leaving a trace. If this is true, it adds to our difficulties in distinguishing between the species of *Scomber.* Kishinouye says that there is also a difference in habitat between "hirasaba" and "marusaba", but this has no taxonomic importance as the young can have another mode of life than the adults.

2. **Rastrelliger** Jordan & Starks

(Jordan & Starks, Proc. U. S. Nat. Mus. XXXIV, 1908, p. 607)

Fusiform, body and cheeks covered with small scales, those of the breast somewhat larger than the others. Eyes with a well developed adipose eyelid. Small teeth in the jaws. Palate edentulous. Gill rakers long and numerous, visible when the mouth is opened, the mouth looking as if "full of feathers". Two dorsals, the first consisting of spines, the second of soft rays, and similar to the anal which has no stiff spines. Five or six finlets behind dorsal and anal. Caudal deeply forked. Pectorals with a rather broad base, pointed. Ventrals with a spine and five rays.

Distribution. Indo-Pacific Region.

Key to the Indo-Australian species of Rastrelliger

a. Height 2.79. Head as long as high . . . 1. *R. brachysoma* p. 210.
b. Height 3.1-3.4. Head as long as high . . . 2. *R. neglectus* p. 211.
c. Height 3.4-3.8. Head longer than high . . 3. *R. kanagurta* p. 212.

1. **Rastrelliger brachysoma** (Blkr.)

Scomber brachysoma Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 356. Verh. Bat. Gen. XXIV, Bijdr. kennis Makreel. 1852, p. 34.

D^1. X. D^2. 11 + 6. A. 11 + 6. P. 17. V. I. 5.

Height 2.79. Head 3.15, about as long as high. Eye 3.8, equal to snout and to flat interorbital space. Mouth oblique. Maxillary reaching to below hinderborder of eye. Teeth in jaws minute. No teeth on palate. About 35 gill rakers on lower branch of first arch, 15 on upper branch. Longest gill rakers about as long as snout and half eye. First dorsal spine somewhat shorter than second, which is slightly less than snout and eye. Second dorsal and anal low, their upper border apparently not much concave. Caudal and pectorals broken. Ventrals equal to snout. Bleeker describes the colour as bluish green above, silvery below. Fins yellowish, the first dorsal bordered above with black. Description made after the type and single specimen known, long 120 mm without caudal.

Habitat: Java (Jacarta!). In sea.

Note. I have examined the type in Bleeker's collection in the Leiden Museum. It has not 5, as stated by Bleeker, but 6 finlets behind dorsal and anal, and differs from the other Indo-Australian species of *Rastrelliger* by its great depth. It comes nearest to *R. neglectus* and may be a variant of this species. What has been described by other authors as *brachysoma* is either *neglectus* (see note there) or another not yet described species.

2. **Rastrelliger neglectus** (van Kampen)

Scomber kanagurta Bleeker, Verh. Bat. Gen. XXIV, 1852. Bijdr. kennis Makreel. p. 34. (nec C. V.).

Scomber kanagurta Kner, Novara Exp. Fische I, 1865-1867, p. 142 (nec C. V.).

Scomber brachysoma Day, Fishes of India, Part II, 1876, p. 251 (nec Blkr).

Scomber brachysoma Evermann & Seale, Bull. Bur. Fish. XXVI, 1906, p. 61 (nec Blkr.).

Scomber neglectus van Kampen, Bull. Départ. de l'Agric. Indes Néerl. VIII (Zool. II), 1907, p. 7.

?*Rastrelliger brachysomus* Jordan & Dickenson, Proc. U. S. Nat. Mus. XXXIV, 1908, p. 190 (nec Blkr).

?*Rastrelliger brachysomus* Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 796 (nec Blkr.).

?*Rastrelliger brachysoma* Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 132. (nec Blkr.).

Scomber neglectus Delsman & Hardenberg, De Indische Zeevisschen. Batavia. 1934. p. 331.

?*Rastrelliger brachysoma* Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 104 (nec Blkr.).

D^1. XX-XI. D^2. 12-13 + 5. A. 12 + 5. P. 2. 16-18. V. I. 5.

Height 3.1-3.4, 3.8-4 in length with caudal. Head as long as high, 3.2-3.5, 3.8-3.9 in length with caudal. Eye 3.6-4.2, 1-1.2 in snout and about equal to the almost flat interorbital space, which has two parallel longitudinal ridges, uniting posteriorly on occiput. Mouth oblique, maxillary reaching to below middle of eye. A single series of small, pointed, and somewhat hooked teeth in the jaws. No teeth on palate. About 29-34 gill rakers on lower branch of first arch, the longest ones equal to distance between pupil and point of snout. First dorsal spine shorter than second, which equals length of snout and eye, seventh dorsal spine equal to pupil, following spines very small. Anterior rays of second dorsal longest, equal in length to fourth spine of first dorsal, last ray of second dorsal equal to half length of pupil. Upper border of second dorsal concave. Origin of anal slightly behind that of second dorsal. Anal similar to second dorsal. Pectorals triangular, slightly longer than ventrals, and equal to postorbital part of head. Colour of preserved specimens brown with a bluish tinge on back, sides and belly silvery. A row of dark spots along base of first dorsal. Fins yellowish, excepting first dorsal which is hyaline, the front and upper border slightly dusky. Tip of anterior rays of second dorsal also more or less dusky. Length 219 mm.

Nomen indig.: Kembung perampuan (Malay).

Habitat: Singapore; Sumatra (Telokbetong, Benkulen, Padang, Coast of Deli!, Bagan Si Api Api); Banka; Java (Jacarta); Borneo (Serawak, Sandakan, Mouth of River Kapuas); Celebes (Makassar); Ambon. — Andamans, Philippines. In costal waters.

Note. Van Kampen (l.c.) pointed out, that the two common species of *Rastrelliger* in the Java Sea have been confused by Bleeker and others. The species which Bleeker called *loo* C. V., is the same as that of the French authors, but it is a synonym of *kanagurta* C. V. This species therefore has to be called *kanagurta*. The other species is mentioned by Bleeker and others as *kanagurta*, and had therefore to be renamed. Van Kampen called it *neglectus*. As may be seen from the synonymy given above, Van Kampen's views have not been accepted by later authors, excepting Delsman & Hardenberg (l.c.). Generally the species called *neglectus* by Van Kampen is mentioned as *branchysoma* Blkr., but lastnamed species is probably different (see above), being still deeper. Many authors record 44-45 gill rakers on the lower branch of the first arch, which fact suggests that there are still other species, or perhaps races of one and the same species, not yet described. The two species differ in that *kanagurta* is more slender than *neglectus*. Delsman & Hardenberg also mention a difference in the gill rakers. They find only 20 rakers on the lower branch of the first arch in *kanagurta*, and about 30 in *neglectus*, which difference they attribute to the different mode of life of the two species: *kanagurta* being an open sea form, feeding on the coarse pelagic plancton, the other a coastal form, feeding on the finer neritic plancton. I do not find this difference in my material, and Van Kampen also comes to the conclusion that the number of gill rakers in the two species is the same. The question therefore is still far from being settled.

3. **Rastrelliger kanagurta** (C.) (Fig. 36, p. 214)

Scomber kanagurta Cuvier, Règne Animal. II, 1817, p. 313, footnote.

Scomber kanagurta Rüppell, Atlas Reise N. Afrika. Fische des rothen Meeres. 1828, p. 93.

Scomber kanagurta Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1931, p. 49.

Scomber loo Cuvier & Valenciennes, ibid. p. 52.

Scomber kanagurta Rüppell, Neue Wirbelthiere. Fische des rothen Meeres. 1835, p. 37.

Scomber chryzosoma Rüppell, l.c.

Scomber microlepidotus Rüppell, ibid. p. 38.

Scomber microlepidotus Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1087.

Scomber loo Bleeker, Verh. Bat. Gen. XXIV, Bijdr. kennis Makreel. 1852, p. 35.

Scomber moluccensis Bleeker, Acta Soc. Indo-Neerl. I, 1856, Beschr. Vischsoorten Amboina. p. 40.

Scomber microlepidotus Günther, Cat. Brit. Mus. II, 1860, p. 361.

Scomber loo Kner, Novara Exp. Fische I, 1865-1867, p. 142.

Scomber microlepidotus Kner, ibid. p. 143.

Scomber loo Steindachner, Sitzber. Akad. Wien 1868, p. 987.

Scomber microlepidotus Steindachner, ibid. p. 988.

Scomber reani Day, Proc. Zool. Soc. London, 1870, p. 690.

Scomber kanagurta Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 441.

Scomber microlepidotus Klunzinger, ibid. p. 443.

Scomber lepturus Agassiz, Pisces Celebes, 1874, Tab. 2.

Scomber microlepidotus Day, Fishes of India. Part II, 1876, p. 250.

Scomber kanagurta Günther, Fische der Südsee II, 1876, p. 149 (partim?).

Scomber kanagurta Macleay, Proc. Linn. Soc. New S. Wales IX, 1884, p. 27.

Scomber kanagurta Klunzinger, Fische des rothen Meeres I, 1884, p. 109.

Scomber kanagurta Kitahara, Journ. Fish. Bur. Tokyo, VI, N° 1, 1897, p. 1.

Scomber kanagurta Jordan & Evermann, Proc. U.S. Nat. Mus. XXV, 1902, p. 336.

Scomber kanagurta Fowler, Proc. Acad. Nat. Sc. Philadelphia LVI (1904) 1905, p. 757.

Scomber microlepidotus Jordan & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 12.

Scomber microlepidotus Evermann & Seale, ibid. p. 61.

Scomber kanagurta van Kampen, Bull. Départ. de l'Agricol. Indes-Néerland. N° VIII (Zool. II), 1907, p. 1.

Scomber kanagurta Bean & Weed, Proc. U.S. Nat. Mus. XLII, 1912, p. 602 (pro parte).

Scomber moluccensis M. Weber, Siboga Exp. Fische, 1913, p. 400.

Scomber loo M. Weber, ibid. p. 401.

Rastrelliger Kanagurta Jordan & Starks, Ann. Carnegie Mus. XI, N° 3-4, 1917, p. 440.

Scomber kanagurta Fowler & Bean, Proc. U.S. Nat. Mus. LXII, 1922, p. 18.

Rastrelliger chrysozonus Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 406.

Rastrelliger microlepidotus Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 796.

?*Scomber kanagurta* Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 132.

Rastrelliger chrysozonus Lin, Lingu Sc. Journ. XIII, 1934, p. 674.

Rastrelliger kanagurta Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVII, 1935, p. 138. — ibid. 1936, p. 380. — Hongkong Naturalist VII, 1936, p. 65.

Scomber microlepidotus Blegvad, Danish Sc. Inv. Iran, Part III, 1944, p. 159.

D^1. X. D^2. 12 + 5. A. 12 + 5. P. 2. 17. V. I. 5.

Height 3.4-3.8, 4.1-4.7 in length with caudal. Head somewhat longer than high, 3.2-3.3, 3.9-4.3 in length with caudal. Eye 4.1-4.6, 1.2-1.3 in snout, and equal to or somewhat less than flat interorbital space. Mouth oblique, maxillary reaching to below hind-border of eye or not so far in young specimens. A single series of very small teeth in the jaws, almost obsolete in adults, more distinct in the lower than in the upper jaw. No teeth on palate. About 35-38 gill rakers on lower branch of first arch, the longest equal to distance between pupil and point of snout. First dorsal spine shorter than second, which is equal to snout and eye; seventh one equal to pupil, following very small. Anterior rays of second dorsal longest, equal in length to fourth spine of first dorsal, last ray of second dorsal as long as half length of pupil. Upper border of second dorsal concave. Origin of anal somewhat behind that of second dorsal. Anal similar to second dorsal. Pectorals pointed, half length of pupil longer than ventrals, and equal to postorbital part of head. Colour of preserved specimens silvery, back bluish grey. Dark stripes or rows of spots along the upper part of sides, not always distinct. Fins light yellowish, base of second dorsal more or less dusky. Length 390 mm.

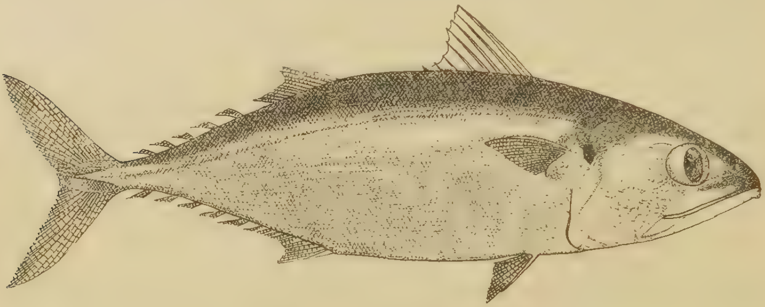

Fig. 36. *Rastrelliger kanagurta* (C.) × $^1/_3$.

Nomen indig.: Kembung lelaki (Malay).

Habitat: Singapore; Bintang; Sumatra (Telokbetong, Benkulen, Priaman, Padang); Java (Jacarta, Anjer, Prigi); Bali; Lombok; Celebes (Makassar, Bulukomba, Badjoa, Menado, Tombariri); Flores!; Rotti!; Timor; Ambon; Ceram!; Batjan; Ternate; Halmahera; Kei Islands!; Waigeu; New Guinea. — East Coast of Africa, Seychelles, Red Sea, Coast of Arabia, Persian Gulf, Coasts of India, Ceylon, Andamans, Nicobars, Coasts of Burma, Siam, Malaya, China, Japan, Formosa, Philippines, Pelew Islands, Queensland, New Ireland, Bougainville Islands, Solomon Islands, New Hebrides, Fiji, Samoa. In open sea.

Note. See note below *R. neglectus*.

3. **Grammatorcynus** Gill

(Gill, Proc. Acad. Nat. Sc. Philadelphia 1862, p. 125)

Nesogrammus Evermann & Seale, Bull. Bur. Fish. XXVI (1906), 1907, p. 61.

Elongate, fusiform. Small, deciduous, cycloid scales covering body and cheeks. No corselet. Two lateral lines, one beginning at upper end of gill opening and running along superior part of sides to below penultimate dorsal finlet, where it joins the second one, which branches off from the first above posterior part of pectoral, runs vertically downwards and then in a curve tailwards to lower side of body, ending in the median elevated ridge at base of caudal, which has two more ridges, one above and one below the median one. Pointed teeth in the jaws, and villiform ones on vomer, palatines and tongue. Two dorsals, the first with XI-XII strong spines, the second with a spine and 9-10 branched rays. Anal with one or two spines and 11 branched rays. Six or seven dorsal, and six anal finlets. Pectorals falcate, ventrals with a spine and 5 branched rays. Caudal deeply forked. Gill rakers well developed. Gill membranes free. Distribution that of the single species known.

1. **Grammatorcynus bicarinatus** (Q. G.). (Fig. 37, p. 216)

Thynnus bicarinatus Quoy & Gaimard, Voyage Uranie & Physicienne. Zool. 1824, p. 357.
Thynnus bilineatus Rüppell, Neue Wirbelthiere, Fische des rothen Meeres, 1835, p. 39.
Thynnus bilineatus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 443. — Fische des rothen Meeres I, 1884, p. 113.
Nesogrammus piersoni Evermann & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 61.
Grammatorcynus bicarninatus McCulloch, Proc. Linn. Soc. New S. Wales XL, Part II, 1915, p. 266. — Austr. Zoologist. Part III, 1922, p. 106.
Grammatorcynus bilineatus Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 413.
Nesogrammus thompsoni Fowler, Occas. Papers B. P. Bishop Mus. VIII, N° 7, 1923, p. 376.
Grammatorcynus thompsoni Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 135.
Grammatorcynus belineatus Hardenberg, Treubia XV, Afl. 2, 1935, p. 137.

D^1. XI-XII. D^2. I. 9 + 7 or I. 10 + 6. A. I-II. 11 + 6. P. 1. 23-24. V. I. 5.

Height 4.1-4.7, 4.9-5.7 in length with caudal. Head 4.3, 5.1-5.3 in length with caudal. Eye 3.65-4.3, 1.2-1.5 in snout and 1.3-1.4 in flat interorbital space. Mouth slightly oblique, maxillary reaching to below anterior half of eye. A row of strong pointed teeth in the jaws. Villiform teeth in a rounded patch on vomer, in an elongate patch on palatines, and in a quadrangular patch on tongue. Second spine of first dorsal longest, almost equal to postorbital part of head, following spines decreasing in length, the last one minute. Fin depressible in a deep groove. Second dorsal falcate, its greatest height equal to postorbital part of head. Anal similar to second dorsal, its origin below posterior part of that fin. Pectorals somewhat more than snout and eye. Ventrals half as long as pectorals or somewhat longer, their origin somewhat behind that of pectorals. Caudal deeply forked. Colour of preserved specimens bluish above, light below. Fins more or less dusky, especially at tip. Length 963 mm.

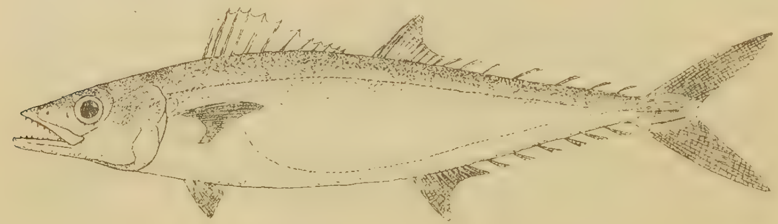

Fig. 37. *Grammatorcynus bicarinatus* (Q. G.) × 1/5.

Habitat: Java Sea!; North Celebes. — Red Sea, Riu Kiu Islands, Philippines, Marshall Islands, Coasts of Australia, Hawaii.

4. **Euthynnus** (Lütken) Jordan & Gilbert

(Lütken in Jordan & Gilbert, Bull. U.S. Nat. Mus. XVI, 1882, p. 429)

Katsuwonus Kishinouye, Sui. Gak. Ho. I. 1915, p. 21. — Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 452.

Fusiform. Small scales forming a corselet in the anterior half of the body; the body outside the corselet without scales. A single lateral line. Small teeth in a single row in the jaws, present or absent on palatines and vomer. Two dorsals, the first consisting of XV spines, the second of flexible spines or unbranched rays and branched rays, and originating close to the end of the first dorsal. Anal similar to second dorsal. Eight dorsal and seven anal finlets. Gill rakers well developed. Gill membranes free.

Distribution: All tropical and temperate seas.

Key to the Indo-Australian species of Euthynnus

a. Palate edentulous. Origin of anal below end of second dorsal. Longitudinal dark bands on belly . . . . 1. *E. pelamis* p. 217.

b. Teeth on palatines and sometimes on vomer. Origin of anal slightly behind that of second dorsal. Belly without dark bands, dark blotches may be present between pectorals and ventrals . . . . 2. *E. alletteratus affinis* p. 218.

1. **Euthynnus pelamis** (L)

Scomber pelamis Linné, Systema Nat. Ed. 10. I. 1758, p. 297.
Scomber pelamys Bloch Schneider, Syst. Ichth. 1802, p. 23.
Scomber pelamides Lacepède, Hist. Nat. Poissons III, 1802, p. 14.
Thynnus pelamys Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 113.
Thynnus pelamys Schlegel, Fauna Japonica, Pisces, 1842, p. 96.
Thynnus pelamys Bleeker, Acta Soc. Sc. Indo-Neerl. I, 1856, p. 41.
Thynnus pelamys Günther, Cat. Brit. Mus. II, 1860, p. 364.
Pelamys pelamys Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 289.
Thynnus pelamys Günther, Fische der Südsee II, 1876, p. 151.
Thynnus pelamys Day, Fishes of India, Part II, 1876, p. 252.
Thynnus pelamys Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 191.
Gymnosarda pelamis Jordan & Evermann, Fishes of North and Middle America. Part I, 1896, p. 868. — Bull. U.S. Fish Comm. XXIII (1903) 1905, p. 172.
Gymnosarda pelamis Evermann & Seale, Bull. Bur. Fish. XXVI (1906) 1907, p. 61.
Katsuwonus pelamis Kishinouye, Journ. Coll. Agric. VIII, N°. 3, 1923, p. 453.
Katsuwonus pelamys E. K. Jordan, Proc. U.S. Nat. Mus. LXVI, Art. 33, 1935, p. 13.
Euthynnus pelamis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 132. — ibid. XI, N° 5, 1931, p. 325.
Katsuwonus pelamis Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 105.
Euthynnus (Katsuwonus) pelamis Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 150, 152.

D^1. XV. D^2. 2. 12-14 + 8. A. 3. 12 + 7. P. 2. 24. V. I. 5.

Body fusiform, head pointed. Height 3.7-3.8. Head 3.1-3.4. Eye about 7, somewhat more or less than twice in snout. Maxillary reaching to below anterior part of eye. About 50 small, conical teeth in each ramus of both jaws. No teeth on vomer and palatines. Lateral line with a decided curve immediately beneath the second dorsal. Corselet well developed, the scales of its anterior half, especially those on back, larger than the others and of a rhombic form. The posterior border of the corselet is roughly formed by a line connecting end of base of first dorsal with the base of the pectoral. Anterior spines of first dorsal much longer than following, forming a pointed lobe The first spine almost equal to postorbital part of head. Origin of second dorsal close to the end of the first dorsal; its anterior rays longest, about two thirds of anterior spines of first dorsal, its upper border concave. Origin of anal slightly behind that of second dorsal, similar in form to second dorsal. Pectorals short, slightly less than postorbital part of head. Ventrals shorter. Caudal deeply forked. Dark above, silvery below. Four or more longitudinal more or less wavy dark bands on belly. Length 1000 mm.

Nomen indig.: Tongkol Krai (Bawean); Tjakalang (Menado).

Habitat: Singapore; West Coast of Sumatra; Bawean; Coast of North Borneo; Celebes (Menado); Batjan; Ambon. — Warm parts of Atlantic, Indic, and Pacific, wandering into temperate zones during summer.

Note. *E. pelamis* is a pelagic fish, living in shoals. The localities mentioned above refer to places, where these fishes have been brought to market. According to Delsman & Hardenberg (De Indische zeevisschen en Zeevisscherij, Batavia, 1934, p. 338) this fish is caught now and again in the seas of the Indo-Australian Archipelago, but never in great numbers. Herre l.c. says that it occurs in great abundance along the coast of North Borneo.

2. **Euthynnus alletteratus affinis** (Cantor) (Fig. 38, p. 220)

Thynnus thunnina Schlegel, Fauna Japonica, Pisces, 1842, p. 95 (nec C. V.).
Thynnus affinis Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1088.
Auxis taso Bleeker, Verh. Bat. Gen. XXIII. Bijdr. kennis ichth. fauna Midden- en Oost-Java, 1850, p. 8 (nec C. V.).
Thynnus thunnina Bleeker, Verh. Bat. Gen. XXIV. Bijdr. Makreel. 1852, p. 36 (nec C. V.).
Thynnus affinis Günther, Cat. Br. Mus. II, 1860, p. 363.
Pelamys thunnina Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 289 (nec C. V.).
Thynnus thunnina Day, Fishes of India, Part II, 1876, p. 252 (nec C. V.).
Thynnus thunnina Günther, Fische der Südsee II, 1876, p. 150 (pro parte).
Thynnus affinis Macleay, Descr. Cat. Austr. Fishes I, 1881, p. 191.
Thynnus thunnina Klunzinger, Fische des rothen Meeres I, 1884, p. 111 (nec C. V.).

Thynnus thunnina Günther, Zool. Challenger Exp. XXXI. II. 1889, p. 17 (nec C. V.).

Euthynnus allitteratus Steindachner, Ann. Hofmuseum Wien XI, 1896, p. 209 (nec Raf.).

Gymnosarda alletterata Jordan & Evermann, Bull. U.S. Fish Comm. XXIII (1903) 1905, p. 173 (nec Raf.).

Pelamys affine Fowler, Proc. Acad. Nat. Sc. Philadelphia LVI (1904), 1905, p. 761.

Euthynnus alletteratus Snyder, Proc. U.S. Nat. Mus. XLII, 1912, p. 496 (nec Raf.).

Gymnosarda alletterata McCulloch, Rec. Austr. Mus. X, N° 7. 1917, p. 183 (nec. Raf.).

Euthynnus alletterata McCulloch, Austr. Zoologist II, Part III, 1922, p. 105 (nec Raf.).

Euthynnus yaito Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 457.

Euthynnus yaito Jordan & Hubbs, Mem. Carnegie Mus. X, 1922-1925, p. 220.

Euthynnus yaito Chabanaud, Bull. Soc. Zool. France L, 1925, p. 200.

Euthynnus alletteratus E. K. Jordan, Proc. U.S. Nat. Mus. LXVI, Art. 33, 1925, p. 13 (nec Raf.).

Euthynnus alletteratus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 133 (nec Raf.). — ibid. XI, N° 5, 1931, p. 325. — ibid. N° 6, 1934, p. 400.

Euthynnus yaito Chevey, Travaux Sc. Inst. Ocean. Indochine, 4e Mém. 1932, p. 113.

Euthynnus yaito Giltay, Mém. Mus. Royal Hist. Nat. V, 1933, p. 85.

Euthynnus alletteratus Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 441 (nec Raf.).

Gymnosarda alletterata Fortonese, Boll. Mus. Zool. R. Univers. Torino XLV, 1935-1936, p. 41 (nec Raf.).

Euthynnus yaito Herre, Copeia 1945, N° 3, p. 148.

Euthynnus affinis affinis Fraser-Brunner, Ann. Mag. Nat. Hist. (12). II, 1949, p. 624.

Euthynnus affinis yaito Fraser-Brunner, l.c.

Euthynnus affinis Fraser-Brunner, ibid. (12) III, 1950, p. 150.

D^1. XV. D^2. 2.11 + 8. A. 2.12 + 7. P. 2.24. V. I. 5.

Height 3.6-4, 3.9-4.8 in length with caudal. Head 3.2-3.4, 3.6-3.8 in length with caudal. Eye 5.7-6, 1.6 in snout and 1.7-1.8 in somewhat convex interorbital space. Mouth oblique. Maxillary reaching to below middle of eye. A single series of slightly curved conical teeth in both jaws, those of the lower jaw stronger than those of the upper jaw. Minute teeth in a single row on the palatines and in an irregular double row on the tail of the vomer. Hindborder of corselet formed by a line from base of second dorsal to behind tip of ventrals, but with a strong emargination on the back reaching to below 8th spine of first dorsal, bordered below by the lateral line, and another emargination reaching well before base of ventrals.

The scales of the corselet are larger, better developed, and more or less rhombic on the back and above the pectorals. Below the pectorals the scales are thinner, and the border of the corselet is more indicated by the difference in smoothness of the skin than by the presence of scales. This area of the corselet is also produced posteriorly in a point above the ventrals. Lateral line scaled. Anterior dorsal spines almost as long as postorbital part of head; following spines rapidly decreasing in length to the 8th, which equals half eye. Following spines subequal, the last one minute. Second dorsal half length of its base behind first. Anterior rays longest, about half as long as longest spine of first dorsal, median rays shortest, hence the fin with a lunate edge. Origin of anal below end of second dorsal, to which it is similar. Pectorals equal to postorbital part of head. Ventrals shorter, equal to snout and eye. Lateral line almost straight, with a slight curve downwards below second dorsal. Lateral keels on caudal peduncle well developed. About 24 gill rakers on lower branch of first arch, two thirds of length of corresponding gill filaments and about three fourths or less of length of eye. Colour dark above, silvery below. The upper emargination of the corselet, the point of which is blunt, and the area behind it to the caudal, bordered below by the lateral line brown, blue in life, with a number of dark oblique bands, forming loops, and less regular anteriorly. Three large brown blotches in a triangle on the lower emargination of the corselet, between pectorals and ventrals, not always distinct. Fins brownish. Length 750 mm.

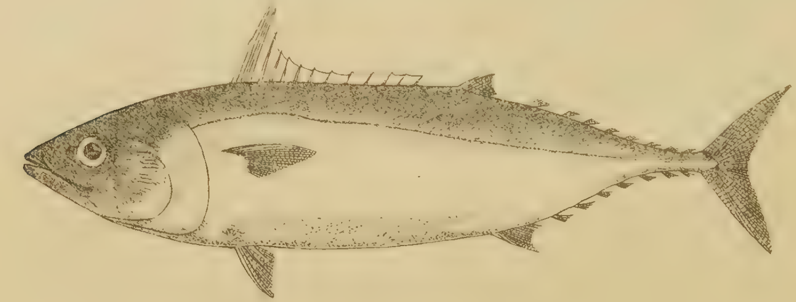

Fig. 38. *Euthynnus alletteratus affinis* (Cant.) × $^3/_5$.

Habitat: Pulu Weh!; Singapore; Sumatra (Telokbetong); Java (Jacarta, Samarang, Pasuruan, Besuki); Celebes (Makassar); Batjan; Ambon; Ceram!; Banda!; North of Misol; New Guinea-

Coast of Natal, Seychelles, Réunion, Red Sea, Arabian Sea, Coasts of India, Siam, Indochina, Japan, Riu Kiu Islands, Formosa, Penang, Philippines, between Admirality Islands and Japan, Coasts of New South Wales, Society Islands, Hawaii.

Note. *Euthynnus alletteratus* is a circumtropical species. Günther (1876, l.c.) drew attention to the difference in the course of the dark bands on the back between Indic and Atlantic specimens, which are oblique in the first, longitudinal in the second. Kishinouye separated the two on account of the vomerine teeth, which are present in Indo-Pacific specimens, but wanting in Atlantic ones. Chabanaud, however, found vomerine teeth in both, but records other differences, such as the number and length of the gill rakers, the number of teeth in the jaws, the distance between the articulation of the first pectoral ray and the opercle, the form of the emargination of the corselet and the development of the keels on the caudal peduncle. As to the vomerine teeth, Steindachner l.c. found them in a specimen from Japan, but not in specimens from St. Thomas and Nice. Klunzinger l.c. misses them, as well as palatine teeth, in two specimens of 750 mm length from the Red Sea, and suggests that they are only present in young ones.

Cantor described the Indo-Pacific form as *affinis,* but did not compare it with *alletteratus* but with *pelamis.* As his name is older than *yaito* of Kishinouye, it has priority. Perhaps it has even to give way to *quadripunctatus* of Geoff. St. Hilaire, who figured *Scomber quadripunctatus* (Descr. Egypte, Poissons, 1814, Tab. 24, Fig. 3) after a specimen from the Red Sea.

5. **Thunnus** South

(South, Encyclop. Metropolitana V, 1845, p. 620)

Thynnus Cuvier, Règne Animal, Ed. I, Tome II, 1817, p. 313 (preoccupied).
Albacora Jordan, Proc. Acad. Nat. Sc. Philadelphia 1888, p. 180.

Fusiform. Small scales forming a corselet in the anterior half of the body. The body outside the corselet covered by much smaller scales. Small teeth in a single row in the jaws, on vomer and palatines. Two dorsals, the first consisting of spines, the second of unbranched and branched rays, and originating close to the end of the first dorsal. Anal similar to second dorsal. Six to nine dorsal and anal finlets.

Distribution: All tropical and temperate seas.

Key to the Indo-Australian species of Thunnus

a. Pectorals as long as their distance from tip of snout . . . . 1. *T. sibi* p. 222.
b. Pectorals as long as head.
  1. Second dorsal and anal falcate, the anterior rays longer or much longer than head without snout . . . . 2. *T. marcropterus* p. 223.
  2. Second dorsal about as high as first dorsal 3. *T. tonggol* p. 225.

1. **Thunnus sibi** (Schl.)

Thynnus sibi Schlegel, Fauna Japonica, Pisces, 1842, p. 97.
Thynnus germo Günther, Fische der Südsee II, 1876, p. 151 (nec Lac.).
Pelamys sibi Bleeker, Verh. Akad. Amsterdam XVIII (1877) 1878, Enumeration poissons Japon, p. 15.
Orcynus sibi Kitahara, Journ. Fish. Bur. Tokyo VI, N° 1, 1897, p. 1.
Germo germo Jordan & Evermann, Bull. U.S. Fish Comm. XXIII (1903) 1905, p. 174 (nec Lac.).
Germo germon Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII, Part 4, 1904, p. 506. — Proc. Acad. Nat. Sci. Philadelphia LVI (1904) 1905, p. 761 (nec Lac.).
Parathunnus mebachi Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 442.
Germo sibi Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 33.
Parathunnus sibi Jordan & Hubbs, ibid. p. 218.
Parathunnus sibi E. K. Jordan, Proc. U.S. Nat. Museum LXVI, Art. 33, 1925, p. 12.
Parathunnus sibi Jordan & Evermann, Occas. Papers Calif. Acad. Sc. 1926, p. 17.
Kishinoella zacalles Jordan & Evermann, ibid. p. 27.
Germo sibi Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 134. — ibid. XI, N° 5, 1931, p. 325.
Parathunnus sibi Fowler, ibid. N° 6, 1934, p. 400. — Monogr. Acad. Nat. Sc. *Philadelphia* II, 1938, p. 66.
Thunnus (Parathunnus) obesus Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 144 (partim?).

D^1. XIII-XV. D^2. 3. 11 + 9. A. 3. 11 + 8-9. P. I. 31. V. I. 5.

Height about 3.5-3.8. Head about 3.4-3.5. Eye 5.7-6, about twice in snout. Mouth oblique. Maxillary reaching posteriorly till opposite first third of eye. Teeth small, conic, sharp, and uniserial in jaws. Vomer with a patch of minute teeth. Palatines with similar elongate and narrow patches. Anterior nostril nearer front rim of pupil than tip of snout. Posterior a vertical slit a little less than half orbit and placed in last third of space between its front rim and anterior nostril. Interorbital space and entire top of head convex. Gill rakers 5-10 + 16-18, compressed, pointed, and longest two thirds of orbit. Corselet apparently without distinct emarginations behind, the anterior scales enlarged. First or third spine of first dorsal longest, equal to snout and eye or somewhat shorter. Spines rapidly decreasing in length to the 8th, following spines subequal or very slightly diminishing in length posteriorly, the anterior part of the fin hence elevated and pointed. Second dorsal originating close behind end of first one, the anterior rays nearly as long as longest spines of first dorsal, the upper edge of the fin concave. Anal similar to second dorsal, its origin below middle of second dorsal. Pectorals long, pointed; in large specimens they scarcely surpass the origin of the second dorsal, but in small specimens about 1 m in length, they reach to the first dorsal finlet. Ventrals about equal to snout and half eye. Lateral line superior and convex at first, then expanding down on middle of side of caudal peduncle to keel. Base of caudal with a low keel above and below. Back nearly black to greyish blue. Sides silvery. In young specimens the sides are greyish with rows of transverse lighter dots and stripes. Dorsal fins greyish tinged yellow at the margin of the tip. Finlets yellow, white at the point. Pectorals black dorsally, greyish ventrally, and the tip sometimes washed with yellow. Ventrals greyish, tinged with yellow. Anal white with a yellow tip. Anal finlets greyish. Length 2000 mm (compiled, not seen by me).

Habitat: Singapore; Sumatra (Padang). — Japan, Riu Kiu Islands, Marquesas, Hawaii.

Note. This species which according to authors may be identical with *Thunnus obesus* Lowe from the Atlantic, has often been confounded with *Th. germo* (Lac.) (= *alalunga* Gm. L.). Lastnamed species differs however in having a much longer pectoral, reaching to above the anterior finlets of the anal, and the dorsal finlets are never yellow. It agrees with *sibi* in the position of the second dorsal, close to the end of the first one. Kishinouye mentions differences in the course of some bloodvessels, which induced him to put *sibi* (= *mebachi*) in a new genus *Parathunnus*. *Thunnus germo* has not yet been recorded from the Indo-Australian Archipelago, although it has been found in the Philippines.

2. **Thunnus macropterus** (Schl.) (Fig. 39, p. 224)

Thynnus macropterus Schlegel, Fauna Japonica, Pisces, 1842, p. 98.
Thynnus macropterus Day, Fishes of India, Part II, 1876, p. 253.
Orcynus macropterus Kitahara, Journ. Fish. Bur. Tokyo VI, N° 1, 1897, p. 2.

Germo macropterus Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 228.
Neothunnus macropterus Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 446.
Neothunnus macropterus E. K. Jordan, Proc. U. S. Nat. Mus. LXVI. Art. 33. 1925, p. 13.
Neothunnus macropterus Jordan & Evermann, Occas. papers Calif. Acad. Sc. XII, 1926, p. 20.
Neothunnus itosibi Jordan & Evermann, ibid. p. 22.
Germo macropterus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 134. — ibid. XI, N° 6, 1934, p. 400.
Thunnus macropterus Delsman & Hardenberg, De Indische Zeevisschen, Batavia, 1934, p. 339.
Neothunnus macropterus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 106.
Neothunnus macropterus Fowler, Hongkong Naturalist VI, 1936, p. 68.
Neothunnus macropterus Whitley, Rec. Austr. Mus. XX, N° 1, 1937, p. 13. ibid. N° 4, 1939, p. 273.
Thunnus (Neothunnus) albacora Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 144 (partim?)

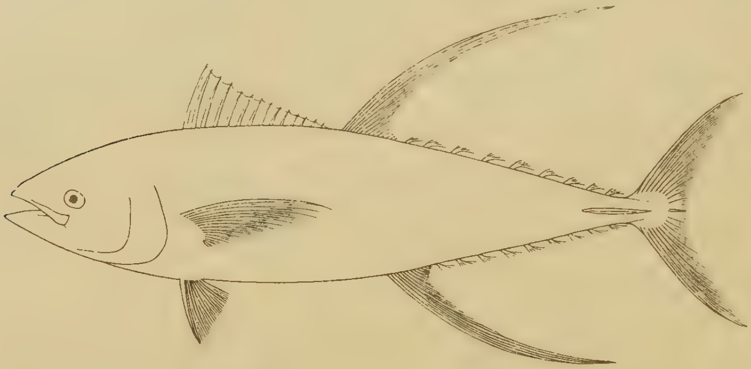

Fig. 39. *Thunnus macropterus* (Schl.). After Delsman & Hardenberg.

D^1. XIII-XIV. D^2. 14 + 9. A. 14-15 + 8-9.

Height 3.6-3.7. Head about 3.7. Eye 6-7, somewhat more or less than twice in snout. Mouth oblique. Maxillary reaching to below anterior part of eye. Teeth in a single series in either jaw, in an angular patch prolonged posteriorly on the vomer, and in a band on the palatines. First dorsal spine equal to snout and eye, following spines gradually decreasing in size to the last, the upper edge of the fin nearly straight or slightly concave. Second dorsal and anal long and pointed, much deeper than longest spine of first dorsal and sometimes even reaching to caudal. Pectorals about as long as head. Ventrals equal to postorbital part of head or somewhat shorter. Posterior margin of corselet indistinct. Colour nearly black on the back, sides greyish with oblique transverse lines and series of silvery white dots. First dorsal greyish tinged with yellow, tips of second dorsal, anal, and dorsal and anal finlets bright yellow. Pectorals black on the inner side, greyish or sometimes yellowish on the outer side. Length 2000 mm (compiled, not seen by me).

Nomen indig. Geulang kadawung or kawung (Sundanese, Wijnkoopsbay).

Habitat: Off east coast of Sumatra, Java (Jacarta, Wijnkoopsbay); North Celebes; Batjan; Ambon. — Red Sea, Coasts of India, Japan, Riu Kiu Islands, Philippines, Pelew Islands, Coasts of Queensland and New South Wales, Pacific eastwards to Hawaii, Galapagos Islands and Southern California.

3. **Thunnus tonggol** (Blkr.)

Thynnus tonggol Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 356. — Verh. Bat. Gen. XXIV, 1852, Bijdr. Makreelacht. Visschen, p. 89.
Neothunnus rarus Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 448.
Kishinoella rara Jordan & Hubbs, Mem. Carnegie Mus. X, 1922-1925, p. 219.
Neothunnus tonggol Jordan & Evermann, Ocass. Papers Calif. Acad. Sc. XII, 1926, p. 26.
Thunnus maccoyi Mc Culloch, Mem. Austr. Mus. V, 1929, p. 263 (pro parte).
Neothunnus rarus Deraniyagala, Ceylon Journ. Sc. B. XVIII, 1933, p. 49.
Thunnus rarus Delsman & Hardenberg, De Indische Zeevisschen, Batavia. 1934, p. 336.
Thunnus nicolsoni Whitley, Mem. Queensland Mus. XI, 1936, p. 30.
Thunnus tonggol Tortonese, Boll. Mus. Zool. Anat. Comp. Torino XLVII, 1939, p. 326.
Kishinoella tonggol Serventy, Journ. Council for Scientific and Ind. Research XV, N° 2, 1942, p. 101.
Thunnus (Kishinoella) tonggol Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 145.

D^1. XII-XIII. D^2. 2.12 + 8 or 2.11 + 9. A. 2.12 + 8 or 2.11 + 9. P. 2.27. V. I. 5.

Height about 4.3. Head about 4. Eye 5.6, 1.6 in snout. Mouth oblique. Maxillary reaching to below middle of eye. Rather large conical teeth in a single series in the jaws. Patches of small teeth on vomer and palatines. Corselet with two posterior emarginations, the upper one surpassing point of pectoral, the lower one reaching to anus. First dorsal spine equal to snout and eye, following spines gradually decreasing in length to the sixth, the posterior spines only slightly diminishing in size; the upper edge of the fin concave in its anterior half, almost straight posteriorly. Second dorsal and anal falcate, their greatest depth about twice that of the body. The first dorsal and anal finlets are often adnate to the second dorsal and anal, in which case there are only 8 free finlets. Pectorals half length of snout shorter than head. Ventrals somewhat shorter than snout and eye. Origin of pectorals below that of first dorsal. Origin of ventrals slightly behind that of pectorals. Colour according to Bleeker: Back greyish blue, sides silvery greyish with colourless elongated spots in about five longitudinal rows. Dorsals, pectorals, and ventrals blackish, but the tip of the second dorsal and the anal washed with yellow. Anal silvery. Finlets, both dorsal and anal, yellowish with greyish margin. Length 800 mm. (Typical specimens of Bleeker's collection in the Leiden Museum seen by me).

Habitat: Singapore; Java Sea; Sulu Sea; Celebes Sea; Mollucas. — From Japan to Australia to about Lat. 37° S. East, limit of distribution unknown. In the Indic known from the Gulf of Aden, the Coast of Ceylon, and the Maldive Islands.

6. **Auxis** Cuvier

(Cuvier, Règne Animal, Ed. II. Vol. II, 1829, p. 199)

Fusiform, rather elongate. Scales forming a corselet. Body outside the corselet naked. Minute teeth in the jaws. Palate edentulous. Two dorsals, the first consisting of X spines and well removed from the second dorsal, which is very small. Anal similar to second dorsal. Six to nine finlets behind dorsal and anal. Gill rakers rather long, slender, and numerous.

Distribution: A few species in tropical and temperate seas.

1. **Auxis thazard** (Lac.)

Scomber thazard Lacepède, Histoire Naturelle Poissons III, 1802, p. 9.
Scomber rochei Risso, Ichthyol. Nice, 1810, p. 165.
Thynnus rocheanus Risso, Hist. Nat. Europe méridionale III, 1826, p. 417.
Auxis vulgaris Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 139.
Auxis taso Cuvier & Valenciennes, ibid. p. 146.
Auxis thynnoides Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 301.
Auxis Rochei Steindachner, Döderlein, Denkschr. Akad. Wien XLIX, 1884, p. 180 (partim?).
Auxis rochei Günther, Cat. Brit. Mus. II, 1860, p. 369.
Auxis thazard Jordan & Evermann, Fishes North and Middle America, Part I, 1896, p. 867.

Auxis thazard Steindachner, Ann. K. K. Hofmuseum 1896, p. 210.
Auxis thazard Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII(1903) 1905, p. 171.
Auxis hira Kishinouye, Sui. Gak. Ho. I, 1915, p. 23.
Auxis thazard Mc Culloch, Austr. Zoologist II, Part III, 1922, p. 104.
Auxis thazard Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 31.
Auxis hira Jordan & Hubbs, ibid. p. 221.
Auxis hira Kishinouye, Journ. Coll. Agric. Tokyo, VIII, N° 3, 1923, p. 462.
Auxis thazard Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 132. — Ann. Natal Mus. VII, Part III, 1934, p. 416. — Hongkong Naturalist VII, 1936, p. 69.
Auxis thazard Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 152.

D^1. X. D^2. 11 + 6-9. A. 14 + 6-8. P. 23. V. I. 5.

Height 4-4.1. Head 3.2-3.7. Eye 5-5.4, 1.25-1.3 in snout and 1.25-1.4 in the interorbital space, which is flat above. Mouth somewhat oblique. Maxillary reaching to below anterior half of eye. Teeth in jaws minute, none on palate. First and second dorsal spines subequal, equal to snout and eye. Following spines rapidly decreasing in length, the 8th shorter than pupil. Second dorsal very low, almost thrice its base distant from first dorsal. Anal similar to second dorsal. Pectorals somewhat more than snout and eye, their origin well before that of first dorsal. Ventrals shorter than snout and eye, their origin somewhat behind that of pectorals. Caudal deeply incised, the lobes pointed. Hindmargin of corselet running from base of second dorsal headwards to above end of pectoral, here turning tailwards again with a rounded curve, forming a posterior emargination as it turns sharply headwards again to almost below base of pectoral, from where it turns again tailwards with a rounded curve to well behind tip of ventrals. Gill rakers rather long, slender and numerous. Colour of preserved specimens brownish above, silvery below. Length over 390 mm. (Description made after specimens of *Auxis thynnoides* of Bleeker's collection in the Leiden Museum).

Habitat: Pulu Weh!; Java (Jacarta); North Celebes; Ambon; Ternate; New Guinea. — All warm seas. "This species is very erratic in its movements, swimming in large schools in various warm seas" (Jordan & Evermann).

7. **Acanthocybium** Gill

(Gill, Proc. Acad. Nat. Sc. Philadelphia 1862, p. 125)

Elongate, more or less compressed, covered with small narrow scales. Snout long, beak-like. Mouth large. Teeth in the jaws triangular, compressed, closely set, slightly serrated, in a single series. Villiform bands of teeth on vomer and palatines. Two dorsals, the first long, of XXVI-XXVII spines, the second short, of 10-11 rays. Anal similar to second dorsal, its origin slightly behind that of lastnamed fin. Nine to ten finlets behind second dorsal, and eight to nine behind anal. No gill rakers. Vertebrae 23 + (31-33). Gill laminae reticulated.

Distribution that of the single species known.

1. **Acanthocybium solandri** (C. V.)

Cybium solandri Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 192.
Cybium sara Lay & Bennett, Zoology of Capt. Beechey's Voyage, 1839, p. 63.
Cybium solandri Günther, Fische der Südsee II, 1876, p. 153.
Acanthocybium solandri Boulenger, Proc. Zool. Soc. London, 1897, p. 272.
Acanthocybium solandri Jenkins, Bull. U. S. Fish Comm. XXII (1902) 1904, p. 441.
Acanthocybium solandri Jordan & Evermann, ibid. XXIII (1903) 1905, p. 176.
Acanthocybium forbesi Seale, Philipp. Journ. Sc. VII, N° 4, 1912, p. 283.
Acanthocybium sara Jordan & Starks, Ann. Carnegie Mus. XI, Nos 3-4, 1917, p. 441.
Acanthocybium solandri Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 411.
Acanthocybium solandri E. K. Jordan, Proc. U. S. Nat. Mus. LXVI, Art. 33, 1925, p. 13.
Acanthocybium solandri Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 135. — ibid. XI, N° 5, 1931, p. 325. — ibid. N° 6, 1934, p. 400.
Acanthocybium solandri Hardenberg, Treubia XIV, Livr. 3, 1934, p. 292.
Acanthocybium solandri Fowler, Hongkong Naturalist VII, 1936, p. 74. — Monogr. Acad. Nat. Sc. Philadelphia II, 1938, p. 67.

D^1. XXVII. D^2. I. 6 + 10. A. II. 11. + 8.

Body elongate, fusiform. Height about 7 in total length. Head 6.6 in total length. Eye about 6 in snout. Snout about 1.3 in head. Lower jaw somewhat longer than upper jaw. About 50 triangular, slightly serrated teeth in each jaw. Bands of villiform teeth on vomer and palatines. Cleft of mouth extending to below eye. Posterior part of maxillary covered by preorbital. Lateral line arched in anterior part, straight behind 17th dorsal spine. Scales very small. Pectorals reaching to below 10th dorsal spine. Dark grey with faint traces of vertical bands (Not seen by me. Description made by Hardenberg, l.c., after a specimen of 1500 mm, from Jacarta fishmarket).

Nomen indig. Tengiri salassi or Tengiri bahar (Malay).

Habitat: Java (Jacarta). — Arabian Sea, Ceylon, Japan, Riu Kiu Islands, Formosa, Philippines, Coasts of Queensland, Solomon Islands, Ellice Islands, Samoa, Society Islands, Paumotu Islands, Marquesas, Christmas Islands, Hawaii, Cuba, Coast of Florida, Mediterranean. In sea, pelagic. According to Kishinouye not living in shoals.

8. **Scomberomorus** Lacepède

(Lacepède, Hist. Nat. Poissons III, 1802, p. 292)

Cybium Cuvier, Règne Animal, Ed. II, Vol. II. 1829, p. 199.

Elongate, fusiform. Body naked or practically so. Small scales in the lateral line generally present. Mouth wide. Upper and lower jaw with strong caninoid teeth; villiform teeth on vomer and palatines. Gill rakers poorly developed, and sometimes almost absent. First dorsal consisting of XII-XXII spines, second dorsal, originating close to last spine of first dorsal, with 15-21 rays, of which the anterior ones are unbranched. Anal similar to second dorsal, with 15-22 rays. Five to ten dorsal and four to ten anal finlets. Pectorals rather short, ventrals with one spine and 5 rays, still shorter. Caudal deeply forked. The single lateral line often wavy in its posterior part, ending on median part of caudal peduncle in a ridge, apparently consisting of modified scales. Generally a lower ridge above, and one below the median one.

Distribution: All tropical and moderate seas.

Key to the Indo-Australian species of Scomberomorus

1. Three rudimentary gill rakers on lower branch of first arch. Teeth in jaws, at least in large specimens, minutely serrated along their edges . . . . 1. *S. commersoni* p. 230.
2. More than three gill rakers on lower branch of first arch. Teeth without serrations.
    - *a.* Origin of second dorsal about midway between base of upper caudal rays and tip of snout.
        - a^1. Teeth more crowded, those of the lower jaw longer than those of the upper jaw. Sides with longitudinal rows of dark spots, often obsolete . . 2. *S. guttatus* p. 232.

b^1. Teeth stronger, more distant, those of the lower jaw not larger than those of the upper jaw. Interorbital space more convex. In life with a dark band from dorsal to anal . . . . 3. *S. croockewiti* p. 234.

b. Origin of second dorsal midway between base of upper caudal rays and eye. Sides with longitudinal streaks, disappearing in preserved specimens . . . . 4. *S. lineolatus* p. 235.

1. **Scomberomorus commersoni** (Lac.)

Scomber commerson Lacepède, Hist. Nat. Poissons II, 1800, p. 598, p. 600.
Cybium commersonii Rüppell, Atlas Reise N. Afrika. Fische des Rothen Meeres, 1828, p. 94. — Neue Wirbelthiere, Fische des rothen Meeres, 1835, p. 41.
Cybium Commersonii Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 165.
Cybium commersonii Richardson, Rep. Fifteenth Meeting Brit. Ass. Adv. Sc. 1846, p. 268.
Cybium commersoni Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1090.
Cybium konan Bleeker, Nat. Tijdschr. Ned. Indië I, 1851, p. 357. — Verh. Bat. Gen. XXIV, Bijdr. Makreel. 1852, p. 39.
Cybium commersonii Günther, Cat. Br. Mus. II, 1860, p. 370.
Cybium Commersonii Day, Fishes of Malabar, 1865, p. 69.
Cybium Konam Kner, Novara Exp. Fische I, 1865-1867, p. 144.
Cybium Commersonii Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 444. — Fische des Rothen Meeres I, 1884, p. 112.
Cybium Commersonii Day, Fishes of India, Part II, 1876, p. 255.
Cybium commersonii Günther, Proc. Zool. Soc. London 1887, p. 662.
Cybium Commersonii Sauvage, Poissons de Madagascar, 1891, p. 320.
Scomberomorus commersonii McCulloch, Austr. Zoologist II, Part III, 1922, p. 105.
Cybium commersoni Jordan & Hubbs, Mem. Carnegie Mus. X, 1922-1925, p. 214.
Cybium commerson Kishinouye, Journ. Coll. Agric. Tokyo VIII, N° 3, 1923, p. 416.
Scomberomorus commersoni Barnard, Ann. S. Afric. Mus. XXI, Part II, 1927, p. 802.
Cybium Commersonii Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 559.
Scomberomorus commerson Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 132.
Scomberomorus commerson Whitley, Sc. Rep. Great Barrier Exp. Brit. Mus. IV, N° 9, 1932, p. 289.
Scomberomorus commerson Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVII, 1935, p. 138, p. 380. — Hongkong Naturalist VII, 1936, p. 71.
Cybium commerson Whitley, Mem. Queensl. Mus. XI, 1936, p. 32.
Scomberomorus commerson Munro. Mem. Queensl. Mus. XII, Part II, 1943, p. 74.
Scomberomorus (Cybium) commerson Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 158, 161.

D^1. XVI. D^2. 16 + 9-10. A. 17 + 9-10. P. 2.20-21. V. I. 5.

Height 4.2-5.9, 4.8-6.2 in length with caudal. Head 3.7-4.4, 4.2-4.9 in length with caudal. Eye 4.3-6.7, 1.5-2.6 in snout and 1.2-2.1 in convex interorbital space. Mouth large, slightly oblique, jaws equal in young, upper jaw the longer in large specimens. Maxillary reaching to below hindborder of eye. About ten distant compressed pointed canines, minutely serrated along their edges, at least in larger specimens, in each ramus of both jaws. Villiform teeth in an oval patch on vomer and in a much elongate patch on palatines. Gill rakers rudimentary, three developed on lower branch near its posterior end. Preopercle with feeble denticulations on lower part of its hindborder. A postocular patch of lanceolate scales, not reaching hindborder of preopercle. Anterior spines of first dorsal as long as snout in young specimens, much less than snout in large ones. Height of first dorsal decreasing in height posteriorly. Upper border of second dorsal deeply concave, the first rays much longer than the posterior ones and as long as snout or longer. Origin of anal about below middle of second dorsal, in shape equal to last-named fin but less deep. Pectorals somewhat falcate, as long as snout in small specimens, equal to snout and eye in large ones. Ventrals half as long as pectorals, inserted slightly behind origin of pectorals. Median and upper and lower keels on caudal peduncle moderately developed. Lateral line with a sharp curve downwards below anterior dorsal finlets, more accentuated with age, and continued in a more or less wavy course to median keel on caudal peduncle. Colour of preserved specimens brownish or bluish grey above, silvery on sides and belly. On the sides numerous transverse dark bands, rounded above and below, sometimes broken into

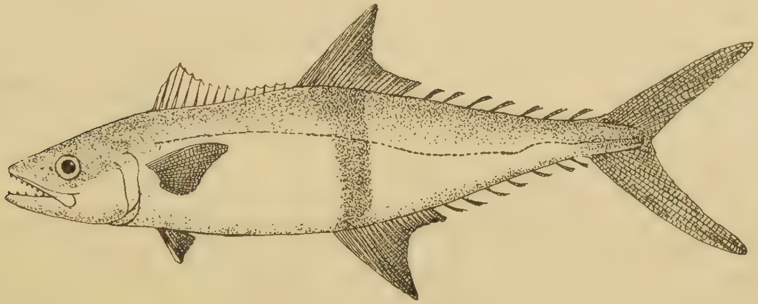

Fig. 40. *Scomberomorus croockewiti* (Blkr). After a drawing in the Leiden Museum, made for the Atlas under Bleeker's direction.

shorter rods or spots, sometimes distinct, sometimes only visible under certain light, comparatively broader in young specimens than in old ones. Anterior part of first dorsal black, posterior part white with a black edge; in old specimens the fin is more uniform greyish. Second dorsal, anal, finlets, and caudal brownish or yellowish, the lobes of dorsal and anal more or less dusky. Pectorals yellowish, the posterior border broadly dusky. Ventrals yellowish or brownish. Length over 1000 mm.

Nomen indig. Tenggiri (Malay).

Habitat: Singapore; Sumatra (Benkulen, Padang, Tiku, Coast of Deli!); Banka; Java (Jacarta!, Batu Ulo!); Borneo (Santubong, Kapuas River); Celebes (Makassar); Batjan; Aru Islands; New Guinea (Hood Bay). — East Coast of South Africa, Madagascar, Mauritius, Réunion, Zanzibar, Red Sea, Arabian Sea, Coasts of India, Siam, Pinang, China, Japan, Formosa, Philippines, Coasts of Queensland, Tasmania, Fiji. In sea and brackish water.

Note. Barnard l.c. following Gilchrist and Thompson records *Cybium commersonii* M. Weber, Abh. Senckenb. Naturf. Ges. XXXIV, 1911, p. 31, from the Aru Islands, as a synonym of *C. flavobrunneus* Smith, and therefore also gives the Aru Islands as a habitat of lastnamed species. Weber gives no description and only cites Lacepède and Günther. Apparently the authors made a slip in putting Weber's reference under *flavobrunneus* in stead of *commersoni*.

2. **Scomberomorus guttatus** (Bl. Schn.)

Scomber guttatus Bloch Schneider, Syst. Ichth. 1801, p. 23.
Cybium guttatum Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 173.
Cybium kuhli Cuvier & Valenciennes, ibid. p. 178.
Cybium guttatum Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1093.
Cybium guttatum Bleeker, Verh. Bat. Gen. XXIV, 1852. Bijdr. Makreel. p. 22, p. 38.
Cybium guttatum Günther, Cat. Brit. Mus. II, 1860, p. 371.
Scomberomorus guttatus Fowler, Proc. Acad. Nat. Sc. Philadelphia LVI (1904) 1905, p. 766.
Scomberomorus guttatus Jordan & Seale, Proc. Davenp. Acad. Sc. X (1905) 1907, p. 6.
?*Cybium guttatum* Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 559.
Scomberomorus guttatus Fowler, Journ. Bombay Nat. Hist. Soc. XXXIII, Part I, 1928, p. 108. — Hongkong Naturalist VII, 1936, p. 72.
?*Cybium guttatum* Blegvad, Danish Sc. Inv. Iran. Part III. Fishes Iranian Gulf, 1944, p. 160.

Scomberomorus guttatus Fraser-Brunner, Ann. Mag. Nat. Hist. (12) III, 1950, p. 157, 160.

D1. XV-XVI. D2. 4.15-17 or 7.15 + 8-10. A. 3. 15-17 or 5.15 + 7-9. P. 2. 17-18. V. I. 5.

Height 3.7-4.4, 4.7-5.6 in length with caudal. Head 4.1-4.5, 5.2-5.6 in length with caudal. Eye 4-5.2, 1.3-1.6 in snout and 1.2-1.5 in convex interorbital space. Mouth oblique. Maxillary reaching almost or quite to below hindborder of eye. Moderate, compressed, pointed teeth in the jaws, those of the lower jaw longer than those of the upper jaw. Villiform teeth on vomer and palatines. Tongue smooth. Gill rakers 1 or 2 on upper branch, 8-10 on lower branch of first arch, short and flattened. Origin of second dorsal about midway between base of upper caudal rays and tip of snout. Second dorsal and anal falcate, the origin of the latter about one eye diameter behind that of the former. Lateral line almost straight to below middle of second dorsal, gently bent downwards from here to middle of caudal peduncle, and ending here in the well developed median ridge, its course on tail sometimes somewhat wavy. Pectorals as long as head without snout. Ventrals, the origin of which is somewhat behind that of pectorals, as long as snout. Colour of preserved specimens brownish or bluish above, more or less silvery below. Sides with several longitudinal rows of dark spots, often obsolete. Length 450 mm.

Nomen indig. Tengiri (Malay). Tandang (Bagan Si Api Api). Tengiri papan (Malaya) Ajong-ajong (Pasuruan).

Habitat: Singapore; Sumatra (Bagan Si Api Api!, Padang, Benkulen); Banka; Java (Jacarta, Cheribon!, Pasuruan, Djurangan); Borneo (Sinkawang, Padangtikar Bay!, river Kapuas, Serawak); Madura; Celebes (Makassar); Ambon. — Iranian Gulf?, Coasts of India?, Siam?, Indochina?, Malaya, China, Formosa. In sea and coastal waters, entering rivers.

Note. The records of the occurrence of this species in Australia are erroneous, and can be referred to *S. semifasciatus* and *queenslandicus* (see Munro, Mem. Queensl. Mus. XII, Part II, 1943, p. 65-95).

I have followed Günther in placing *kuhli* C. V. as a synonym of *guttatus*. The French authors described it after a young specimen collected by Kuhl and Van Hasselt in Java. In the Leiden Museum I examined two specimens, both collected in Java by

Kuhl and van Hasselt, 120 and 225 mm long. They have been labelled "*Cybium kuhli*" probably by Valenciennes, hence they can almost be considered as paratypes. Both belong without doubt to *guttatus*. A third specimen, presented by Prof. van Swinderen in 1845, is also *guttatus*. Munro (cited above) considers *kuhli* as the type of a new subgenus *Pseudosawara*, characterized by a special type of lateral-line branching: "This is not a true ramification but a branching effect produced by the continuation backwards of the area of minutely furrowed skin caused by the presence of tracts of mucous canals". Such areas are seen on the postero-dorsal region of the head of all species of *Scomberomorus*. I find, however, this characteristic not only in the specimens of *kuhli* in the Leiden Museum, but in many specimens of *guttatus* as well, specially in the larger ones, and also in other species. I don't think that this structure is of any use, even to distinguish species. Munro did not base his subgenus on the type, but on *kuhli* as described by Day, (Fishes of India, 1876, p. 254), which according to him is the same as *Cybium guttatum* of Kishinouye (Journ. Coll. Agric. Univ. Tokyo VIII, N° 3, 1923). Day's species, however, cannot be *kuhli* C. V. (= *guttatum* C. V.) if at least the number of pectoral rays, which Day gives as 29, is not a misprint.

Dr. Hardenberg informs me, that the specimens caught in the estuaries of the large rivers of the Sunda Islands can always be recognized by the total lack of spots. Besides the large specimens are flatter than those of the open sea. Possibly they belong to a separate race.

3. **Scomberomorus croockewiti** (Blkr.) (Fig. 40, p. 231)

Cybium Croockewitii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 161. — Verh. Bat. Gen. XXIV, 1852, Bijdr. Makreel. p. 22, p. 37.
?*Cybium Crookewiti* von Martens, Preuss. Exp. Ost-Asien. Zool. Theil I, 1876, p, 390.

D^1. XV. D^2. 7. 17 + 7. A. 3. 17 + 7. P. 2. 18. V. I. 5.

Height 4.3, 5.6 in length with caudal. Head 4.7, 6.1 in length with caudal. Eye 5.2, 1.7 in snout and 1.6 in convex and somewhat keeled interorbital space. Mouth oblique. Maxillary reaching to below hindborder of eye. Lower jaw slightly the longer. Strong compressed, pointed, rather distant teeth in the jaws, those of the lower jaw not larger than those of the upper jaw. Gill rakers well developed, 2 on upper branch, 10 on lower branch of first branchial arch, somewhat longer than half length of gill filaments. Origin of second dorsal midway between base of upper caudal rays and of tip of snout. Second dorsal and anal falcate, the origin of the latter slightly behind that of the former. Lateral line almost straight to below anterior dorsal finlets, gently bent downwards here and continued along the middle of the caudal peduncle to the well developed median ridge. Pectorals and ventrals damaged, the former about as long as head without snout, the latter as long as snout. Colour of the preserved specimen brownish above, silvery below. All fins light or dusky. According to Bleeker a broad black band from dorsal to anal, sides with dark diffuse blotches, first dorsal totally black. Length 450 mm. (Description made after the type in the Leiden Museum).

Habitat: Banka strait near Muntok!; Borneo (Sinkawang); Celebes (Makassar).

Note. In Bleeker's collection in the Leiden Museum there are two specimens of this species. One, 450 mm long, is without doubt the type, the other 245 mm long, is probably from Makassar, the only locality besides that of the type mentioned by Bleeker in his papers. This smaller specimen differs from the type as follows: D^2. 6.15 + 9. A. 5.15 + 8. Eye 1.3 in interorbital space. Gill rakers 2+ 8, less than one half of gill filaments. Both specimens are uniform, without any traces of the black vertical band mentioned by Bleeker. They are very near *guttatus,* differing by having the profile of the head somewhat more ascending, and consequently the interorbital space is more convex and besides somewhat keeled. The teeth in the jaws are larger, less numerous and hence more distant. The gill rakers of the type are longer than those of the specimens of *guttatus* examined by me, but this difference may be not real, as the gill rakers in this genus are proportionally longer in larger specimens than in small ones, and I have not been able to compare the type with specimens of *guttatus* of the same length. I am therefore not sure that *croockewiti* is a good species. The only one besides Bleeker who mentions *croockewiti* is von Martens. He does not describe his specimen which came from Sinkawang, Borneo but only gives the following fin-counts: D^2 4.16 + 8, A. 3.17 + 8. which does not characterize the species.

4. **Scomberomorus lineolatus** (C. V.)

Cybium lineolatum Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 170.

Cybium interruptum Cuvier & Valenciennes, ibid. p. 172.
Cybium lineolatum Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1092.
Cybium lineolatum Bleeker, Verh. Bat. Gen. XXIV, 1852. Bijdr. Makreel. p. 22, p. 40.
Cybium lineolatum Günther, Cat. Brit. Mus. II, 1860, p. 370.
Scomberomorus lineolatus Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 803.
Scomberomorus lineolatus Fowler, Ann. Natal Mus. VII, Part III, 1934, p. 415.
Scomberomorus lineolatus J. L. B. Smith, Rec. Alb. Mus. IV, 1935, p. 210.

D^1. XV. D^2. 3.13 or 5.12 + 9. A. 3.14 or 4.16 + 9. P. 2.22. V. I. 5.

Height 5-5.45, 6-6.6 in length with caudal. Head 4.3-4.4, 5.2-5.4 in length with caudal. Eye 4.9-5.1, 1.4-1.5 in slightly convex interorbital space, and 1.9-2 in snout. Mouth oblique. Upper jaw slightly prominent. Maxillary reaching to below hindborder of pupil. Strong, compressed, pointed teeth in the jaws, those of the lower jaw somewhat stronger than those of the upper jaw. An elongate patch of villiform teeth on vomer, similar teeth in a narrow band on palatines, and in a patch on first basibranchial. Gill rakers on first arch 2 + 9, somewhat longer than half length of pupil. Origin of second dorsal halfway between base of upper caudal rays and eye. Second dorsal and anal falcate, the latter originating slightly behind the origin of the former. Longest dorsal rays about equal to head without snout. Pectorals equal to distance between gill opening and anterior nostril. Origin of ventrals below that of pectorals, ventrals much shorter than pectorals. Lateral line almost staight to below second dorsal finlet, abruptly bent downwards here and ending in a median ridge on caudal peduncle, which is very high. Colour of preserved specimens brownish above, silvery below. Sides with numerous short, blackish, longitudinal streaks, disappaering in preserved specimens. Fins including first dorsal, yellowish. Length 1200 mm. (A specimen of Bleeker's collection in the Amsterdam Museum examined).

Habitat: Singapore; Sumatra (Deli!, Bagan Si Api Api); Java (Jacarta, Japara); Madura; Celebes (Makassar!). — Coast of India, Pinang. In sea.

4. Family HISTIOPHORIDAE

Body elongate, more or less cylindrical. The united premaxillaries and the nasals form a long pointed rostrum, which is rounded in transverse section. Nasals meeting in front of the ethmoid.

Mouth large. Teeth minute, villiform in the jaws. A predentary bone present. Two dorsals and two anals, the anterior ones generally longer than the posterior ones. No finlets behind doral and anal. Ventrals reduced to three or two spines, or to a single one. Scales present. Pectorals placed low. Caudal forked, the rays of each lobe deeply forked at base, parallel to each other and forming an acute angle with those of the opposite lobe. Two longitudinal keels on each side of the caudal peduncle.

Key to the Indo-Australian genera of Histiophoridae

1. First dorsal low, only elevated anteriorly into a pointed lobe. Ventrals moderate . . . . . 1. *Tetrapturus* p. 237.
2. First dorsal very greatly elevated. Ventrals very long . . . . 2. *Histiophorus* p. 239.

1. **Tetrapturus** Rafinesque

(Rafinesque, Caratteri di alcuni nuovi generi e nuove specie di animali etc. Palermo, 1810, p. 54)

Elongate, somewhat compressed. Villiform bands of teeth in both jaws and on palatines. First dorsal with XXXV-LIX spines, low, excepting its anterior part which is elevated as a pointed lobe. Second dorsal with 7 rays. First anal with XII-XV spines, second anal with 6-7 rays, below second dorsal and similar to it. Pectorals falciform, relatively longer in old than in young. Ventrals consisting of a spine and one or two rays, which are united into one or almost so, in adults relatively shorter than in young.

Distribution. A few species from the Mediterranean, Indic, and Pacific.

1. **Tetrapturus brevirostris** (Playf.)

?*Tetrapturus indicus* Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 286.
Histiophorus brevirostris Playfair, Fishes of Zanzibar, 1866, p. 53, p. 145.
Histiophorus indicus Day, Fishes of India, Part II, 1876, p. 199.
Tetrapterus indicus Brown Goode, Report U. S. Fish Comm. 1880, p. 307.
Tetrapterus brevirostris Brown Goode, ibid. p. 308.
Histiophorus gladius Ramsay, Proc. Linn. Soc. New S. Wales V, 1881, p. 295 (nec Brouss.).
Histiophorus gladius Macleay, Descr. Cat. Austr. Fishes I, 1881, p. 157 (nec Brouss.).

Histiophorus brevirostris Günther, Proc. Zool. Soc. London 1887, p. 660.
Tetrapterus brevirostris van Kampen, Nat. Tijdschr. Ned. Indië LXVII, 1907, p. 120.
Tetrapterus indicus McCulloch, Austr. Zoologist II, Part III, 1922, p. 106.
Tetrapterus brevirostris Jordan & Evermann, Occas. Papers Calif. Acad. Sc. 1926, p. 33.
Makaira indica Jordan & Evermann, ibid. p. 67.
Tetrapterus brevirostris Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 136.

D^1. XXXVI. D^2. 7. A^1. XII. A^2. 7. P. 19. V. 2.

Height about 6.5 in total length. Profile of head gradually ascending to dorsal fin. Length of the rostrum (anterior to the mouth) somewhat less than height of head, and equal to half length of remaining part of head. Head without rostrum 5 in total length. Postorbital part of head twice in snout (with rostrum). Rostrum depressed, broader than deep, inferiorly somewhat less convex than superiorly, the sides rounded. Inferiorly covered with very small teeth, sides with bands of somewhat more distinct teeth. The eye is situated in the middle of the head (without rostum); its length goes 5 times in that of the postorbital part of the head. Maxillary reaching more than length of eye beyond eye. Scales lanceolate. Lateral line very indistinct. The height of the first dorsal is less than that of the body and is about two fifths of the total length of the head. The basis of this fin and of the first anal are sunk into a deep groove of the skin. The second dorsal and both anal fins are concave, the last rays of the second dorsal and anal elongate. Pectorals longer than the height of the body but somewhat shorter than the length of the head, measured from the point of the lower jaw, 1.7 in total length of the head, and five sixths of the caudal lobes. Ventrals more than twice as short as pectorals, 4 in total length of the head. Both ridges on the caudal very high, especially the upper one. Dark bluish grey above, lighter below. No white stripes or black points to the fins. The specimen described above was a male (about 3900 mm length). A second specimen about 850 mm total length differs from the larger as follows:

D^1. XXXIX. D^2. 7. A^1. XIII. A^2. 7. V. 3. Height about 8.75-9 in total length. Maxillary reaching but slightly farther than hind-border of eye. Lateral line distinct. Scales very thin, overlapping and therefore looking like normal scales. The spines of the first dorsal increase in length to the fourth, which is somewhat more than height of body and almost half as long as total length of head; following spines decreasing somewhat in size to the eleventh, then they increase again in length, attaining even a greater length than the fourth, the posterior spines gradually decreasing in height again. In the first anal fin the third and fourth rays are the longest. The second ray of the ventrals just reaches the anus, and equals the head without rostrum in length. The first ray is very short, the third one still shorter, and separated by a distinct membrane from the third. Pectorals shorter than height of body, little longer than postorbital part of head and not quite equal to two fifths of the lenght of the ventrals. The caudal ridges are low (Not seen by me, description translated from van Kampen l.c.).

Habitat: Off Sumatra?; Java (Bay of Jacarta, Wijnkoop's Bay). — Zanzibar, Seychelles, Muscat, Coast of New South Wales, Hawaii.

Note. The status of this species is not quite clear. As already suggested by Playfair, l.c., *Tetrapturus lessonae* Canestrini from the Mediterranean may be the same species. Van Kampen thinks it possible that *T. mazara* Jord. & Snyder from Japan is a synonym of *brevirostris*, and Fowler l.c. puts *T. illingworthi, kraussi*, and *ectenes*, described by Jordan & Evermann from Hawaii, in the synonymy of *brevirostris*. I agree with the supposition of van Kampen that the relative length of pectorals and ventrals varies with age, and that the form of the dorsal fin also changes during growth, in the same way as is known to occur in *Xiphias*.

2. **Histiophorus** Lacepède

(Istiophorus Lacepède, Hist. Nat. Poissons III, 1803, p. 274)

corrected spelling: Histiophorus by Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 291.

Elongate, somewhat compressed. Villiform bands of teeth in both jaws and present or absent on palatines. First dorsal with XXXII-XLVIII spines, greatly elevated, much higher than height of body. Second dorsal with 6-7 rays. First anal with X-XI spines. Second anal with 6-7 rays, below second dorsal and similar to it. Pectorals falciform, rather long. Ventrals very long, consisting of a strong spine and one or two rays.

Distribution. A few species from the tropical and subtropical parts of Atlantic, Indic, and Pacific.

Key to the Indo-Australian species of Histiophorus

a. Second dorsal immediately behind first dorsal, the anterior spines of which are not much shorter than the median ones. Upper profile of head gradually ascending to dorsal. Body generally uniform . . . . 1. *H. gladius* p. 240.

b. Second dorsal at some distance behind the first, the anterior spines of which are half as long as the median ones. Upper profile of head steeply ascending to dorsal. Body with transverse rows of light blotches . . 2. *H. orientalis* p. 241.

1. **Histiophorus gladius** (Brouss.)

Scomber gladius Broussonet, Mém. Acad. Sc. 1786, p. 454.
Scomber gladius Bloch, Ausländ. Fische VII, 1793, p. 81.
Xiphias velifer Bloch, Schneider, Syst. Ichth. 1801, p. 93.
Istiophorus gladifer Lacepède, Hist. Nat. Poissons III, 1802, p. 374.
Histiophorus indicus Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 293.
Histiophorus gladius Günther, Cat. Br. Mus. II, 1860, p. 513.
Histiophorus gladius Playfair, Proc. Zool. Soc. London, 1867, p. 856.
Histiophorus gladius Klunzinger, Verh. zool. bot. Ges. Wien, XXI, 1871, p. 468.
Histiophorus gladius Day, Fishes of India, Part II, 1876, p. 198.
Histiophorus gladius Brown & Goode, Report U. S. Fish Comm. 1880, p. 309.
Histiophorus gladius Klunzinger, Fische des rothen Meeres I, 1884, p. 122.
Histiophorus gladius Günther, Proc. Zool. Soc. London, 1887, p. 660.
Istiophorus gladius McCulloch, Rec. Austr. Mus. XIII, n° 4, 1921, p. 137. — Austr. Zoologist II, Part III, 1922, p. 106.
Istiophorus gladius Jordan & Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 30.
Istiophorus gladius Jordan & Evermann, Occas. Papers Calif. Acad. Sc. 1926, p. 38.
Istiophorus gladius Fowler, Hongkong Naturalist VII, 1936, p. 80.

D^1. XLV. D^2. 7. A^1. 10. A^2. 7. P. 18. V. I. 2.

Height 7-8 in total length. Head (with rostrum) 4 in total length. Profile of head gradually ascending to dorsal. Distance between extremity of rostrum and eye 4.5 in total length. Inferior part of rostrum covered with fine pointed granulations, similar but stronger ones on the sides, more pointed and more like normal teeth on that part of the mandibles, which corresponds to the lower jaw, the latter also with small pointed teeth. Origin of dorsal on nape, the anterior rays and those of the posterior third of the fin longest and twice as deep as body. Posteriorly the rays decrease rapidly, and immediately behind them the second dorsal begins. First anal beginning below posterior fourth of first dorsal, second anal below second dorsal, and similar to that fin. Pectorals falciform, 6-7 in total length. Ventrals much longer than pectorals, fitting in a groove of the abdomen. Dark above, light below. First dorsal dark with numerous black spots. Length 4500 mm (Not seen by me. Description after Cuvier & Valenciennes).

Habitat: Singapore, West Coast of Sumatra; Sangi Islands, East Coast of Africa, Mauritius, Seychelles, Red Sea, Arabian Sea, Coasts of India, Siam, Indochina, China, New South Wales, Fiji, Hawaii.

2. **Histiophorus orientalis** Schl. (Fig. 41, p. 242)

Histiophorus orientalis Schlegel, Fauna Japonica, Pisces, 1842, p. 103.
Histiophorus orientalis Lütken, Vidensk. Meddel. natur. Foren. Kjöbenhavn 1875, p. 1.
Histiophorus orientalis Brown & Goode, Report U. S. Fish Comm. 1880, p. 309, p. 375.
Histiophorus orientalis M. Weber, Siboga Exp. Fische 1913, p. 408.
Istiophorus orientalis Jordan & Evermann, Occas. Papers Calif. Acad. Sc. 1926, p. 46.
Istiophorus orientalis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 136.
?*Istiophorus gladius* Fowler, Proc. Ac. Nat. Sc. Philadelphia LXXXIX, 1937, p. 224.

D^1. XLIV-XLVIII. D^2. 6. A^1. 11. A^2. 6. P. 18-19. V. 2-3.

Height 8.5 in total length. Head (with rostrum) 3.5 in total length. Profile of head rather steeply ascending to dorsal. Distance between extremity of rostrum and eye 4.5 in total length. Inferior part and sides of rostrum covered with minute pointed teeth, those of the sides somewhat larger and equal to those of the lower jaw. Palatines with an elongate patch of similar teeth. Origin of dorsal on nape, the anterior spines more than height of body and half as long as median spines. Posterior spines abruptly decreasing in length. Second dorsal at a short distance behind first one. First anal beginnig below posterior fourth of first dorsal. Second anal below second dorsal, and similar to that fin. Pectorals 6.5 in total length. Ventrals much longer than pectorals. Dark above, light below. Body with numerous transverse rows of light blotches. Dorsal dark, with numerous black spots. Length 2680 mm.

Nom. indig. Geulang pajung (Sundanese).

Habitat: Singapore; Java (Bay of Jacarta, Wijnkoop's Bay); Banda! — Japan, Siam?, Hawaii.

Note. It is possible that this species is only a synonym of *H. gladius,* as has already been supposed by Klunzinger and Lütken. As I have seen no specimens, besides the skull and some other parts of the skeleton, I abstain from giving an opinion.

Order BLENNOIDEA

Airbladder without open duct. Parietals generally separated by the supraoccipital. Orbitoshenoid wanting. No bony stay for the praeoperculum. Opercular bones well developed, but the operculum sometimes reduced, and smaller than the suboperculum. Mouth protractile or not. Lower pharyngeals not ankylosed. Dorsal and anal long, the dorsal and anal rays typically corresponding in number to the vertebrae, each basal bone attached to its own neural and haemal spines. The dorsal may consist of a spinous and a soft portion, or all the rays may be spines or articulated. Anal with or without spines. Pectoral spine present or absent. Ventrals, if present, jugular, seldom sub-thoracic, consisting of a spine and a few rays, or spine absent. Scales generally small, ctenoid or cycloid, often wanting.

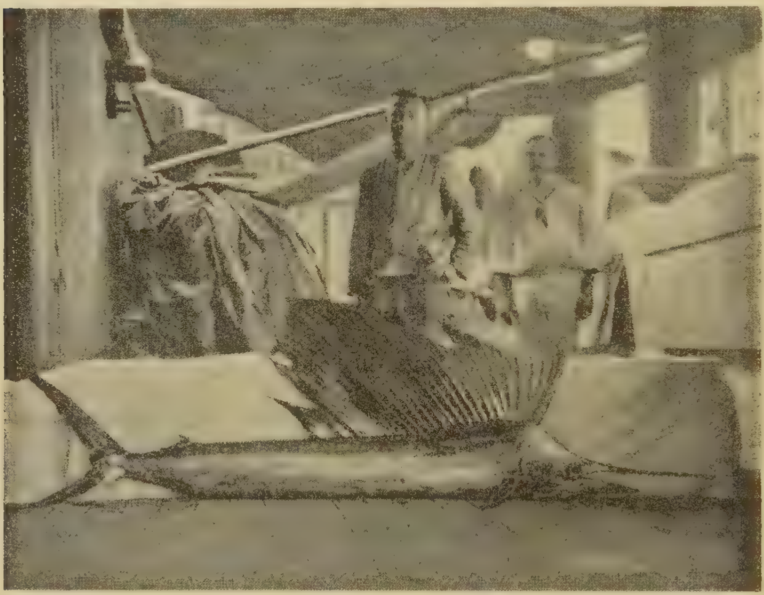

Fig. 41. *Histiophorus orientalis* Schl.

Key to the Indo-Australian families of Blennoidea

I. Vent remote from head, or if vent close to head the ventrals are present.
  A. Ventrals distinctly before base of pectorals.
    a. Ventrals not on the throat between the rami of the lower jaw, but more backward.
      a^1. Body naked. Ventrals each of 2-4 simple rays, and with a hidden spine. Spinous and soft portion of the dorsal generally subequal . . 1. *Blenniidae* p. 243.
      b^1. Body scaly, if naked the ventrals reduced to a simply ray.
        a^2. Dorsal without or with one spine. Caudal joined to dorsal and anal. Ventrals absent. Gill membranes united, free from or united with isthmus . . . 2. *Congrogadidae* p. 383.
        b^2. Each dorsal and anal ray, except the last two, a slender pointed spine. Ventrals reduced to one ray . . . . 3. *Notograptidae* p. 388.
        c^2. Spinous portion of dorsal or dorsals more extended than the soft. Ventrals of a spine and 3-4 simple articulated rays . 4. *Clinidae* p. 389.
        d^2. Dorsal without spines. Caudal generally joined to dorsal and anal. Ventrals generally present. Gill membranes free from each other, and from isthmus. 5. *Brotulidae* p. 398.
    b. Ventrals on the throat, between the rami of the lower jaw . . . . . . 6. *Ophidiidae* p. 445.
  B. Ventrals sub-thoracic, below base of pectorals. No teeth on palate . . . . 7. *Pholidichthyidae* p. 446.
II. Vent placed at the throat. Ventrals absent. 8. *Carapidae* p. 449.

1. Family BLENNIIDAE [1]

Elongate or much elongate. No scales. Teeth in jaws generally in a single, crowded series, often with a posterior canine in the lower jaw. Canines at symphysis only in juvenile *Cirripectus*. Vomerine teeth only in *Entomacrodus*. Palate edentulous. Gill openings often restricted to the sides. Dorsal long, consisting of flexible spines and articulated rays, the spinous and the soft rayed portion usually of equal extent and sometimes separated by a notch. Caudal free or confluent with dorsal and anal. Anal long, generally consisting of articulated rays and with, or without, a few flexible spines anteriorly. All dorsal and anal rays may be flexible spines or articulated rays. Pectorals present. Ventrals jugular, well before pectorals, with a hidden spine and 2-4 rays.

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[1] Dr. W. M. CHAPMAN is the author of the description of the family characteristics, of the key of the family, of the descriptions and synonymy of the first eight genera, and of the descriptions and synonymy of the species belonging to these genera.

Key to the Indo-Australian genera of Blenniidae

A. Gill membranes free from the isthmus; teeth in jaws slender, independently movable, and more than 150 in each jaw, except in *Rhabdoblennius* and *Ecsenius*.
  a. Teeth more than 150 in each jaw, independently movable, set loosely in gums; last anal ray free from caudal peduncle, except in *Salarias* and *Atrosalarias*.
    a^1. A series of at least 20 cirri forming a transverse, almost continuous, series across nape; pelvics I-4; depth of body $2^1/_2$ to 4 in body length (except in juveniles); males with dendritic masses on anal spines and first anal rays; young pelagic, with large, deciduous, anterior canines . . . . . . 1. *Cirripectus* p. 246.
    b^1. No cirri on nape, or one on either side, or not more than two on either side, the pairs widely separated on the mid-line; pelvics I-2 to 4; depth of body 3.2 to 10 in body length, males without dendritic masses on anal spines, and rays, except occasionally in *Entomacrodus* and *Atrosalarias*; young not pelagic and without anterior canines.
      a^2. Caudal with no branched rays in most species, or not more than 7 branched rays (normally less), or with these forked only at tips.
        a^3. Simple nasal, supraorbital and nuchal cirri present; ventrals I-2; dorsal with 10 spines; pectorals 16 or 17; depth 3.2

to 3.5, lateral line continuing to caudal . . . . 2. *Atrosalarias* p. 255.

b^3. Supraorbital cirri branched; nuchal cirri absent; ventrals I-4; dorsal with 13 to 17 spines; pectorals normally 15, occasionaly 14; depth 6.0 to 10.0; lateral line usually absent, or limited to a few pores anteriorly.

a^4. A fleshy oval disk, larger than eye, in the form of a cupped sucker behind lower lip. . . . . 3. *Andamia* p. 257.

b^4. No fleshy, sucker-like disk behind lower lip . . . . 4. *Alticus* p. 264.

b^2. Caudal always with middle 9 rays deeply branched, even in young; pelvics I-2 to 4; pectorals normaly 14, rarely 13; nuchal cirri present or absent.

a^3. Single row of 6 to 10 small conical teeth across head of vomer; pelvics I-4 . . . . 5. *Entomacrodus* p. 272.

b^3. No teeth on vomer; pelvics I-2 or 3 (never 4) . . . . 6. *Salarias* p. 288.

b. Teeth in lower jaw usually 45 to 50 (not more than 70), fixed or barely movable; last anal ray membraneously attached to caudal penduncle.

a^1. Teeth 45 to 50 in both jaws, fixed or barely movable; caudal with middle 9 rays deeply forked, and none exerted noticeably beyond membrane; always either supraorbital or nuchal cirri present . . . . 7. *Rhabdoblennius* p. 346.

b^1. Teeth 45 to 50 in lower jaw, fixed; teeth more than 100 in upper jaw, long, slender, independently movable, and typically Salariin; none of caudal rays forked; two or three often protruding beyond membrane in male; neither supraorbital or nuchal cirri present. . . . . 8. *Ecsenius* p. 352.

B. Gill membranes broadly attached to the isthmus, the openings restricted to sides of head and usually to a small pore above; teeth in jaws less than 70, fixed, and with an enormous posterior canine on either side below.

a^1. Depth of body less than 8 in body length; dorsal 24 to 45 . . . . . . 9. *Petroscirtes* p. 355.
b^1. Depth of body more than 14 in body length; dorsal more than 60.
  a^2. Dorsal and anal free from caudal; origin of dorsal over opercle; dorsal 68 to 70, depth 15 to 16 in length. 10. *Lembeichthys* p. 379.
  b^2. Dorsal and anal confluent with caudal; origin of dorsal above front margin of eye; depth 28 to 36 in body length . . . . 11. *Xiphasia* p. 381.

1. **Cirripectus** Swainson

Cirripectus Swainson, Nat. Hist. Fishes, etc., II, pp. 79, 80. (Cirripectes on pp. 182, 275).
Exallias Jordan and Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, pp. 495, 503.
Gloriella Schultz, Copeia, 1941 (1), p. 17.

D. XI-XII, 12-15. A. II 13-16. P. 15. V. I-4.

No crest on head in either sex. Nasal cirrus branched. Supraorbital cirrus branched (except in *kosiensis*). Nuchal cirrus with 20 to 55 filaments in a transverse, almost continuous, row across nape. Upper lip crenulate for full length (except in *kosiensis*). Lower lip crenulate at least laterally (except *kosiensis*). No vomerine teeth. Posterior canines present or absent. Labial teeth movable, more than 150 in both upper and lower lip; typically Salariin. Depth 2.5 to 4.0. Lateral line continuing back to caudal. Dorsal deeply notched, free from caudal or attached only to first few small rays of caudal. Anal spines of male bearing dendritic genital pads, last ray free from caudal peduncle. Caudal with 9 deeply branched rays. Larvae pelagic, with large anterior canines which are deciduous at transformation to adult stage.

Distribution: Indo-Western Tropical Pacific from East Africa to Easter Island, and from Japan to Northern Australia. Seven or eight species, of which three have been recorded from the Indo-Australian archipelago.

Note: *Cirripectus* is most closely related to the American genus *Ophioblennius*, which also has multiple nuchal cirri (2 to 8 on each side), ventrals I-4, dendritic genital pads on the anal spines of the male, 9 branched caudal rays, a deep body, crenulate upper and lower lips, and pelagic larvae with big, deciduous, anterior canines. Among Indo-Pacific blennies its closest relative is *Entomacrodus* which also has ventrals I-4, crenulate upper lips in most species, a double nuchal cirrus occasionally (*marmoratus*), dendritic pads on male anal spines in some species (*caudofasciatus*), but has a slender body, vomerine teeth and, so far as known, nonpelagic larvae with no anterior canine teeth.

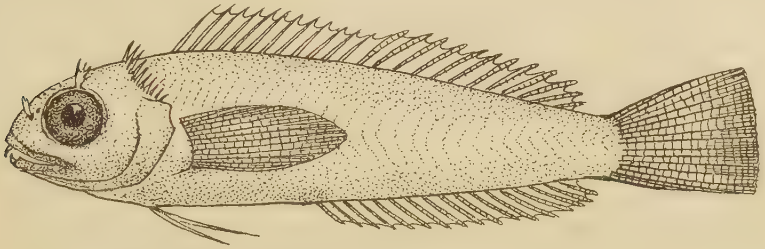

Fig. 42. Larval stage of *Cirripectus*. × 4.

Key to the Indo-Australian species of Cirripectus

A. Body, pectorals, dorsal and caudal fins covered with prominent black spots on a pale background; a pair of barbels on either side of throat under corners of mouth; nuchal cirri on mid-line about three times length of those at end of series, the series frequently overlapping at mid-line to leave inner row of smaller cirri. Dorsal with 12, occasionally 13, rays. No posterior canines. 1. *Cirripectus leopardus* p. 247.

B. Body dark, never uniformly black spotted; pectoral fins without spots; no barbels on throat; nuchal cirri not noticeably longer at mid-line than at ends of series, the series not overlapping at mid-line. Dorsal with 14 or 15 rays, rarely 13. A canine tooth present posteriorly in each lower jaw.

- a^1. Body and head uniformly dark brown; throat plain . . . . 2. *Cirripectus variolosus* p. 249.
- b^1. Body and head with some spots, reticulations or vertical bands; anterior part of throat ordinarily spotted with light. 3. *Cirripectus sebae* p. 251.

1. **Cirripectus leopardus** (Day) (Fig. 43, p. 248)

Salarias leopardus Day, Proc. Zool. Soc. London, 1869, p. 518.
Blennius leopardus Day, Fishes of India, Part II, 1876, p. 203.
Salarias brevis (non Kner) M. Weber, Siboga Exp. Fische, 1913, p. 537.
Cirripectes caninus Herre, Philip. Jour. Sci., 59 (2), 1936; p. 284.
Cirripectes caninus Herre, Philip. Jour. Sci., 70 (4), 1939, p. 342.

Gloriella canina Schultz, Copeia, 1941 (1), p. 18.
Cirripectes leopardus Schultz, Copeia, 1941 (1), p. 18-19.
Cirripectes leopardus Schultz, Bull. U. S. Nat. Mus. 180, 1943, pp. 272, 273.

D. XII. 12-13. A. II. 14-14$^1/_2$. P. 15. V. I. 4.

No crest on head. Nasal cirrus 5 or 6 unbranched filaments, the organ a little longer than pupil but shorter than supraorbital cirrus; longest filaments longer than filaments of supraorbital cirrus. Orbital cirrus a flat pad arising from slender peduncle, the pad nearly as large as pupil, with about 10 filaments arising from its upper circumference, the filaments shorter than the pad. Nuchal filaments single, the ones on the mid-line three times the length of those below, the filaments of the series tapering gradually in length without a free lappet below; series meeting at mid line overlapping, often leaving an inner row of several filaments at apex of nape; series reaching level of lower edge of pupil, but removed from upper corner of gill opening by nearly eye diameter; 30 to 36 filaments in series. Anterior profile almost vertical. Upper lip strongly crenulate throughout, with about 24 lappets, each swollen at tip. Lower lip fully crenulate, not with lappets but by deep grooves covering entire lip. A pair of fleshy tentacles on edge of lateral line system pores directly behind lower lip on either side. No canines. Depth 2.5 to 4.0, growing deeper with age. Head equal to depth or a little shorter. Lateral line curving down to mid-line of body behind pectoral and continuing to caudal, the pores becoming less distinct and more widely spaced posteriorly. Dorsal beginning ahead of opercle by diameter of pupil. Spinous dorsal higher than soft, with well developed notch between; membrane from last ray extending over first small caudal rays. Anal lower than soft dorsal, last ray free from caudal peduncle. Strongly crenulate pads on anal spines of male, black, nearly as large as eye; first spine of

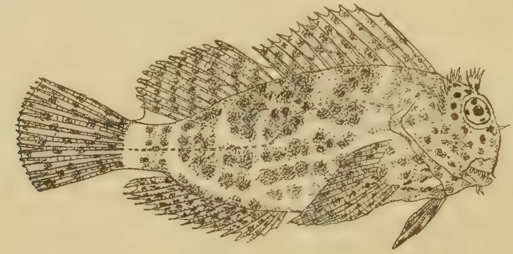

Fig. 43. *Cirripectus leopardus* (Day) n.s.

female hidden in genital pad; rays not modified. Pectoral a little shorter than head.

Colour generally pale, covered with small (less than $^1/_2$ pupil diameter) dark spots on all fins, head, throat and body, including abdomen in adults. Spots on body gathered in groups of 5 to 10 and these groups gathered into paired vertical bands containing 3 to 6 groups (less posteriorly). Body spots often in center of a hexagonal diagram smaller than pupil, especially anteriorly. In very pale specimens only dots stand out and the appearance of grouping is lost, or nearly so. Spots of caudal and pectorals gathered into transverse bands, but those of other fins in no regular order. Anal fin duskier than other fins or body. Throat with suggestion of two semicircular transverse bands, largely obscured by dots. Trace of indistinct, broad, pale band down across cheek behind eye in dark specimens. Lips and rear edge of opercle paler than head in dark specimens.

The young, pelagic *Ophioblennius* or *Gloriella* stage is coloured as in the adult, although the spotting is not so profuse and the dots are proportionately larger. This stage is differentiated from the adult chiefly by the presence of 4 hooked canines anteriorly that protrude from the mouth when closed and are huge when compared with the other teeth.

Habitat: Moluccas (Ternate!), Talaut Islands! — Marshall Islands!, Hawaiian Islands!, Samoa! In sea.

Note: This species has been widely confused with *C. brevis*, from which it is clearly distinguishable as pointed out by Schultz (Copeia, 1941 (1), p. 18). The two species are found side by side in the Marshalls, Hawaii and Samoa, but *C. brevis* has not yet been recorded from the Indo-Australian Archipelago.

2. **Cirripectus variolosus** (C. V.)

Salarias variolosus Cuvier and Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 317.
Salarias castaneus Cuvier and Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 324.
Salarias filamentosus Alleyne and Macleay, Proc. Linn. Soc. N. S. Wales, 1, 1877, p. 337.
Salarias alboapicalis Ogilby, Proc. Linn. Soc. N. S. Wales, 23, 1899, p. 742.
Salarias nigripes Seale, Occas. Papers B. P. Bishop Mus. I, (3) 1901, p. 127.
Salarias variolosus Jenkins, Bull. Fish. Comm. XXII (1902) 1904, p. 507.
Alticus variolosus Jordan and Evermann, ibid, XXIII (1903) 1905, p. 497.
Salarias sebae M. Weber, Siboga Exped. Fische, 1913, p. 537 (pro parte).

Rupiscartes variolosus Jordan and Jordan, Mem. Carnegie Mus. X, 1922-1925, p. 83.

Exallias obscurus Borodin, Amer. Mus. Nov., 281, 1927, p. 1.

Cirripectes variolosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 433. Monogr. Ac. Nat. Sc. Philadelphia II, 1938, p. 243.

Ophioblennius vanderbilti Fowler, Mon. Acad. Nat. Sc. Philadelphia II, 1938, p. 242.

Cirripectes variolosus Herre, Philip. Journ. Sc. LXX, 1939, p. 343.

Cirripectus variolosus Fowler, Proc. Acad. Nat. Sc. Philadelphia XCIII, 1941, p. 276.

Cirripectes variolosus Schultz, Copeia, 1941 (1), p. 19. — Bull. U. S. Nat. Mus. 180, 1943, p. 273.

D. XII (rarely XIII). 14-15. A. II. 15-16. P. 15-16. V. I. 4.

No crest on head. Nasal cirrus with a basal element from whose upper surface arises 3 to 6 filaments (normaly simple of approximately equal length; organ a little longer than pupil diameter. Supraorbital cirrus of 3 to 5 filaments (normally simple and of roughly equivalent size) born on a short pedicle, the whole no longer than the nasal cirrus. Nuchal cirrus a line of 26 to 39 short, simple filaments across nape, the series split on the mid-line with each ending ventrally in a fleshy lappet which bears the last 8 to 10 filaments; a line extended down from nuchal cirrus would touch or lie ahead of posterior margin of opercle, not behind it. Upper lip crenulate for full length but weakly, the crenulations not lappet-like with swollen tips as in *C. leopardus*. Lower lip weakly crenulate on lateral quarters but smooth mesially. A well developed canine posteriorly in each lower jaw. Depth of body 3.1-3.6. Head a little shorter than depth. Lateral line curved down behind pectoral and extending faintly to caudal. Second spine of adult male dorsal longer than first and third, exerted, growing very long with age; first three dorsal spines of female approximately the same length; dorsal deeply notched; membranes of last dorsal ray extending over first small caudal rays in adults; soft dorsal a little higher than spinous. Anal as high as spinous dorsal. Pectorals as long as, or a little longer than, head.

Colour uniformly chocolate brown to nearly black; or with a few to many small, pale, irregular or rounded spots on the lower cheek, under eye, on upper lip and over snout that look, superficially, like pock marks (in the latter form the head, throat and space between lateral line and spinous dorsal may be light tan). Head and throat in light specimens occasionally smudged with darker, but never with any definite dark markings. Upper anterior part of spinous dorsal and, usually, upper posterior part of caudal pale or white. Vertical and ventral fins otherwise quite dark brown. Pectorals pale to dusky. Genital pads of male white. Never any vertical or horizontal dark bands on body. In occasional specimens over 50 mm, however, dark rounded spots appear indistinctly on post abdominal region of the body.

Colour of *Ophioblennius* stage uniformly light tan with fins pale or unpigmented; transformation occuring at 23 to 25 mm.

Habitat: Sula Islands!, Ambon!. — Philippines!; Guam!; Marshall Islands!; Ile-de-France!; Honolulu!; Samoa!; Phoenix Islands!; Solomon Islands!; Society Islands; Easter Island; Wake Island; New Hebrides; Aneitum; Friendly Islands. In sea.

Note: An examination of the types shows *C. castaneus* to differ from *C. variolosus* only in the lack of pock-like pale dots on the front of the head and an increased number of nuchal filaments. The Sula Island and Ambon specimens agree with *castaneus* in both characters. It is probably that the two forms are sub specifically separable and that other forms can be separated on the basis of number of nuchal filaments when adequate series become available for comparison. An examination of the type of *Ophioblennius vanderbilti* Fowler shows it to be the young of this species.

3. **Cirripectus sebae** (C. V.)

Salarias Sebae Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 323.
Salarias Sebae Bleeker, Nat. Tijdschr. Ned. Indië X, 1856, p. 373.
Salarias (Cirripectes) polyzona Bleeker, Versl. Kon. Akad. Amsterdam (2) II, 1868, p. 278.
Salarias sebae Günther, Cat. Brit. Mus. III, 1861, p. 246.
Salarias Sebae, var., Kner, Sitzber. Akad. Wien LVIII, 1868, p. 333.
Salarias Sebae, Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 491.
Salarias sebae, Günther, Fische der Südsee, II, 1876, p. 202.
Alticus variolosus Jordan and Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 424.
Alticus sebae Jordan and Seale, Bull. Fish. XXV (1905) 1906, p. 426 (compiled).
Salarias polyzona M. Weber, Siboga Exp. Fische, 1913, p. 536.
Salarias sebae M. Weber, Siboga Exp. Fische, 1913, p. 537 (pro parte?).
Cirripectes sebae Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 433.

D. XII. 14-15. A. II. 15-16. P. 15. V. I. 4.

Crest absent although a low fleshy ridge often in its place, equally developed in both sexes, not apparent in young, growing more noticeable in large adults. Nasal cirrus with a lateral element from whose upper surface arises 3 to 5 filaments (normally simple) of approximate equal length; a little longer than pupil diameter. Orbital cirrus of 3 to 5 slender filaments (normally simple and of roughly equivalent lengths) born on a short pedicle, the whole no longer than nasal cirrus. A row of 36 to 43 filaments across nape reaching down nearly to top of gill opening and nearly to level of lower edge of eye. A projection of the line of descent of the nuchal cirri would touch rear edge of opercular bone or pass posterior to it. Last nine or ten filaments born on a low fleshy flap, remainder arising directly from skin. Filaments seldom bifid, slender (nearly equal in diameter from base to tip), well separated from each other basally; last filament above gill opening by no more than 1/2 pupil diameter. Profile nearly vertical but with upper lip projecting slightly beyond snout. Maxillary extending behind eye by as much as pupil diameter in large specimens. Upper lip weakly, but plainly, crenulate throughout length, the crenulations most prominent laterally; crenulations mere notches, and not definite lappets with swollen tips. Lower lip smooth mesially, with a few weak crenulations in each corner. Corners of mouth with a broad, double fold, longer than pupil diameter, which permits upper lip to be broadly expanded for the scraping action of feeding. A stout canine, nearly as long as pupil diameter, recurved and fitting cavity in roof of mouth, on either side below. Depth 2.8 to 4.1. Head 3.1 to 4.0. Lateral line tubular with short inconspicuous cross branches back to where it curves down under last three dorsal spines; from there on continued as a line of single pores back to caudal. First dorsal spine of male longer than head, about 3.1 in length without caudal, longer than second spine by 1 1/2 times eye diameter; membrane deeply incised between first three spines; dorsal deeply notched, but only to 1/3 length of next to last spine; last spine 1/2 length of next to last and buried in bottom of notch; membrane from last dorsal ray reaching over small caudal rays to middle of last small caudal ray; first dorsal spine of female scarcely longer than next, shorter than head, about 5.3 in length without caudal. Anal lower than soft dorsal.

Sexes differing little in coloration. Three definite colour patterns passed through during growth beyond *Ophioblennius* stage. *First Stage*: Body light tan. A dim, light triangular area spreading down from eye over upper lip. Head, throat and pectoral light tan, smudged here and there with dusky, but with no definite markings. Dark brown band as wide, or a little wider, than pupil extending from upper end of gill opening out into caudal, where it fades toward edges of fin. Usually some roundish black spots in the dark lateral band, from which the vertical bands in the next stage originate. The spot over the pectoral as large as pupil and nearly always plainly evident. A line running from lower third of first dorsal spine to upper third of next to last spine; fin below this dusky, above clear. Soft dorsal evenly dusky. Caudal pale above, dark in center, dusky below. Anal evenly dusky, darker than body. Pectorals and ventrals tan, the membranes clear. The largest specimen seen with this coloration was 34 mm., without caudal. The next stage of coloration begins in some specimens at 25 mm. *Second Stage*: Posterior $^2/_3$ of throat covered with roundish white spots, no larger than pupil; area ahead of this dusky; posterior edge of gill membrane dusky mesially. These spots extend up over the branchiostegal membrane, opercles, cheeks, under eye, at corner of mouth and, faintly, further up on head, being separated by brown reticulations giving the appearance of a crude honey comb. Longitudinal dark band on body completely disappearing, being replaced by about 12 dark vertical bands, each extending from dorsal edge of body downward. Those over anal fin down to ventral edge of body; those over abdominal cavity not reaching so far ventrally. Last two bands on caudal peduncle variously disrupted ventrally. Fins coloured substantially as in first stage, with brown areas browner and upper part of spinous dorsal and caudal pale. Abdomen unmarked. This stage is found from lengths of 25 to 35 mm. to lengths of 55 to 60 mm., with some specimens being found at either end of the scale which merge into the other stages. In heavily melanistic specimens the body markings may be completely obscured, making the body similar to *C. variolosus* or black *C. quagga*. Traces of the honey comb markings and spots on throat nearly always evident even in blackest specimens. *Third Stage*: Body and fins becoming very dark. Vertical bands nearly completely obscured. Honey comb arrangement of white spots and dark reticulations around them sharply distinct over all of head and throat (except faintly on top of head), over pectoral base and base of pectoral rays, over anterior $^2/_3$ of abdomen, and faintly along base of spinous dorsal anteriorly. Numerous white centered, small, round, dark dots (which may not be white centered on caudal peduncle) over all of body. Some of these markings elongated and appearing as reticulations. Occasional specimens have reticulations anteriorly on body, and dots posteriorly, which are not white centered. The appearance is given that the white-centered, small spot stage is the final one after the reticulations of the second stage break up into dots. Pelvics dark and unmarked. Upper edge of spinous dorsal and caudal remain pale.

Genital pads on anal spines of big males light, with edges of crenulations dark. This colour stage appears to be fully developed after 60 mm and begins to be apparent after 55 mm, length without caudal.

The largest *Ophioblennius* stage of this species available is 20 mm.; the smallest adult stage 19 mm. The post larvae have 4 canines above and 2 below, at the symphysis. All cirri dark. Light spots on dusky showing faintly on lips, cheeks and throat. Only faint beginnings of vertical bands noted on sides of body. Head and body otherwise light, without distinctive markings. Fins all clear.

Habitat: Maumeri, Flores reef!; Moeras reef!; Beo!; Ambon;! Oost. Ind. Archip. (Bleeker Coll.)!; Binonga Island; Kawa, West Ceram; Nalahia, Nusa Laut Island; New Guinea; Ternate; Aru Islands. — Marshall Islands!; Phoenix Islands!; Samoa! Solomon Islands!; Southern Japan!; Fiji!; Bismark Archipelago!

Note: This species was founded by Valenciennes on a pre-Linnean description by Seba (Thesaur. vol. 3, p. 30, No. 5, 1734-35). Seba's illustration and description are so generalized that they could apply to three or four species of *Cirripectus*. The specimen upon which Valenciennes based his description (Paris Museum No. 2039a) has been dessicated rather badly at some time in the past. No trace of any colour pattern remains. The nuchal cirri are so badly damaged that the filaments cannot be counted accurately. However, the lower lip is smooth mesially, the crenulations of the upper lip are weak, as in *variolosus* and the species here called *sebae*. The lappet of the nuchal cirrus remains on the right side and its lower end is not removed from the opercular opening by as much as the pupil diameter. A continuation of its line of travel downward would run just behind the opercular opening. D. XII. 14. A II. 15. Thus it appears safe to say that this is the same as the species called *sebae* by Bleeker, which is identical with the description above, which was drawn chiefly from Marshall Island specimens.

The definition of the colour pattern, and *Ophioblennius*, stages of this species (formerly rare) was made possible by the large series of fresh material obtained by Schultz in the Marshalls. Examination of Bleeker's type of *S. polyzona* shows it to be the second colour stage of the species noted above; his specimens of *sebae* of the third largest stage. The same is true of Weber's *polyzona* and *sebae* specimens.

C. variolosus and *C. sebae* occur together in collections made in Polynesia, Micronesia and Melanesia. In those areas the two species are easily defined by the higher nuchal filament count in the latter (35 to 42 in *sebae*; 29 to 37 in *variolosus*), the more anterior slanting of the nuchal cirri in *variolosus* (the line of travel downward running well forward of the posterior edge of the operculum), and the colour pattern. In the Indo-Australian area, where *variolosus* has higher nuchal filament count, the differentiation can be safely made often only on colour pattern. Both species differ from the closely related *C. quagga,* which occurs with them through Polynesia, Micronesia, and Melanesia, by the latter having the crenulations of the upper lip deep and lappet-like, the lower lip crenulate in the middle as well as laterally, etc.

2. **Atrosalarias** Whitley

Atrosalarias Whitley, Rec. Austral. Mus. XIX, 1933, p. 93.

For description see that of only species, below.

1. **Atrosalarias fuscus** (Rüpp.) (Fig. 44, p. 256)

Salarias fuscus Rüppell, Neue Wirbelthiere, Fische, 1835, p. 135.
Salarias phaiosoma Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 317.
Salarias fuscus Günther, Cat. Brit. Mus. III, 1861, p. 245.
Salarias fuscus Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 191.
Salarias fuscus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 489.
Salarias holomelas Günther, Ann. Mag. Nat. Hist. (4) X, 1872, p. 399.
Salarias fuscus Günther, Fische der Südsee II, 1876, p. 202.
Salarias fuscus Day, Fishes of India, Part II, 1876, p. 330. — Suppl. 1888, p. 797.
Salarias holomelas Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 431.
Salarias fuscus M. Weber, Siboga Exp. Fische, 1913, p. 530.
Salarias fuscus McCulloch & McNeill, Rec. Austr. Mus. XII, 1918, p. 12.
Salarias fuscus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 435. — Occas. Papers B. P. Bishop Mus. IX, 20, 1932, p. 12.
Atrosalarias phaiosoma Whitley, Rec. Austr. Mus. XIX, 1933, p. 93.
Salarias fuscus Herre, Philip. Journ. Sc. LXX, 1939, p. 348. — Rec. Indian Mus. XLI, Part IV, 1939, p. 361.

D. X. 20-21. A. II. 19. P. 16-17. V. I. 2.

No trace of crest on head in either sex. Nasal, supraorbital and nuchal cirri present, simple, slender, pointed and identical except for length; nasal about $^1/_2$ pupil in length; supraorbital about $^1/_3$ eye in length; nuchal a little shorter than supraorbital. Snout evenly rounded and forehead receeding. Upper lip markedly crenulate, but in a different manner than *Salarias*; each crenulation a little lappet nearly as long as wide, 20 to 25 in number, widely (and sometimes irregularly) spaced so that interval between them may be wider than lappet. Lower lip smooth. No canines above or vomerine teeth. A tiny, blunt canine below. Labial teeth, both above and below, numerous, movable and typically Salariin. Depth 3.2-3.5. Head 3.8-4.0. Lateral line curving down behind pectoral and continuing to base of caudal with one pore on each metamere. Dorsal with no trace of notch or emargination; increasing steadily in height to last few rays; first few spines buried in loose membrane; last two rays shortened, but the few before them (in larger specimens) much elongated, reaching well past middle of caudal when fin is depressed; last ray bound fully, or almost so, to caudal, the membrane reaching to first principal ray. None of caudal rays branched even in largest specimens; middle rays long and attenuated, fin being

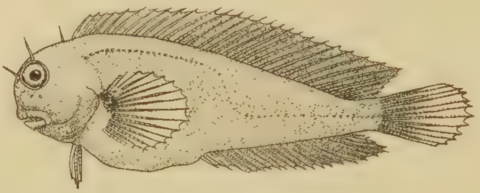

Fig. 44. *Atrosalarias fuscus* (Rüpp.). n. s.

2.6 to 2.9 in length in adults. Caudal and last few dorsal and anal rays increasing markedly with age, all being brief and rounded in young. Two anal spines of male short, bearing thick, rounded, fleshy pads with outer surface covered by irregularly transverse grooves; proximal $^2/_3$ of first ray similarly fleshy and grooved; second ray sometimes a little fleshy and grooved; first 2 or 3 rays particularly elongate, fleshy, with membrane between them excised nearly to base; other rays with only tips free and graduated in length to the third from last, which is extended out to match the dorsal; last two rays shortened, last day bound to caudal peduncle by a membrane which reaches to the first small caudal rays. Dorsal, anal and caudal not so much elongated in female; first anal rays not lengthened and modified; first spine buried in genital papilla. Pectoral shorter than head by length of snout. Two pelvic rays fleshy, of nearly equal length; spine very short, scarcely emerging from membrane, and not visible without dissection. *Male*: colour of head and body uniformly dark, chocolate brown, or abdomen a little paler. Only spot or marking a black spot smaller than eye on upper half of pectoral base. Pectoral and caudal pale in young (said to be yellow in life) but also brown in half grown and adults. Some with lower half of caudal dark, upper half pale. Dorsal same colour as body except last two rays which may be pale. First few anal rays same colour as body, rest of anal nearly black. Pelvics uniform with body. Female: Like male except abdomen a little lighter.

Habitat: Sumatra (Benkulen, Priaman); Java (Jacarta!); Batu Islands; Nias; Sulu Islands!; Sangi Islands; Buru; Damar!; Timor! — Red Sea!; Coasts of India; Nicobars; Philippines!; Pelew Islands; Solomon Islands!; New Hebrides; Fiji; Tonga Islands. In sea.

Note: This distinctive and specialized genus and species appears to be most closely related to *Eczenius* and to the species around *Salarias guttatus*. It differs markedly from both.

3. **Andamia** Blyth

Andamia, Blyth, Journ. Asiat. Soc. Bengal XXVII (1858) 1859, p. 270.

D. XIV-XVII. 17-21. A II. 23-25. P. 15. V. I-4.

Crest on head present or absent. Nasal cirrus simple, tiny (scarcely longer than diameter of nasal pore). Supraorbital cirrus filamented on both sides, length equal to or shorter than eye. No nuchal cirri. Head flattened, nearly twice as wide as deep, the cheeks bulging. Both lips strongly crenulate. No canine or vomerine teeth. Labial teeth more than 150 in each jaw, movable, typically Salariin. A prominent sucker-like fleshy appendage behind lower lip. Depth 7 to 10. Lateral line absent. Dorsal weakly notched with some spines frequently extended beyond membrane in males; last ray free from caudal. Caudal with 12 principle rays, none branched, the tip of all extending beyond membrane. No dendritic pads on anal spines of male; first anal spine of female hidden in genital papilla, and second partially so; last anal ray with basal half membraneously bound to caudal peduncle.

Distribution: Philippines, Indo-Australian Archipelago, Andamans, and Christmas Island (Indian Ocean). Three species.

Note: *Andamia* is closely related to *Alticus* from which it differs principally in the presence of the sucker behind the lower lip. The peculiar amphibious habits are only an extension of those of *Alticus,* which also spends much time out of the water. The fact that these two genera have the ventrals I-4 indicates their ancient derivation from the primitive Salariin stock. In nearly all other characters, however, they are highly specialized (diminution of cirri, slender body, increased dorsal and anal rays, no branched caudal rays, partial attachment of last anal ray to caudal peduncle, sucker of *Andamia*, etc.). For particulars of the specialized habits see H. S. Rao and S. L. Hora: "On the Ecology, Bionomics and Systematics of the Blennioid Fishes of the genus *Andamia* Blyth." Rec. Indian Museum. XL, part IV, p. 377-401, 1938.

Key to the species of Andamia

A. D. XVI-XVII. 17-18. Top of head flat or a little rounded. No crest in either sex. Second dorsal spine elongate and filamentous in both sexes. Small white spots scattered liberally over top of head, back under spinous dorsal and all of body behind anus. Occasionally some black spots on head also . . . . 1. *Andamia tetradactylus* p. 259.

  a^1. Both anal spines visible. Anal uniformly dusky, darker than body, except for tips of rays, which are white . . . . . 1a. *Andamia tetradactylus*, male, p. 259.

  b^1. First anal spine hidden in genital papilla, second partially so. Anal white. 1b. *Andamia tetradactylus*, female, p. 259.

B. D. XIV. 19-21. Other characters as noted below.

  a^1. No crest on head in either sex. A broad pit behind eyes followed by a posterior median groove, with swellings on either side. Second dorsal spine $^1/_3$ to $^2/_3$ length of head. Numerous prominent black spots on head and upper part of pectoral fin . . . . 2. *Andamia heteroptera* p. 260.

    a^2. Both anal spines visible. Anal fin with extensive dark marks on its middle or basal half, or whole fin dark with only tips of rays white. Second dorsal spine moderately produced and filamentous, $^2/_3$ length of head . . . . 2a. *Andamia heteroptera*, male, p. 261.

    b^2. First anal spine hidden in genital papilla. Anal white, without spots or markings. Second dorsal spine not produced or filamentous, $^1/_3$ length of head . . . . 2b. *Andamia heteroptera*, female, p. 261.

  b^1. A prominent crest on head in male. Top of head behind eyes level or rounded, but without pit. Second dorsal spine greatly produced, $^{3}/_{4}$ to twice length of head. No black spots on head, or pectoral fins. Usually numerous white spots scattered over head and a white streak down from eye. . . . . 3. *Andamia reyi* p. 263.

a^2. Both anal spines visible. A triangular, very fleshy, crest as high as eye on head. Second dorsal spine greatly extended beyond fin membrane, $1^{1}/_{2}$ to 2 times length of head. Anal pale basally, with dark submarginal band, and pale ray tips . . . . 3a. *Andamia reyi,* male, p. 263.

b^2. First anal spine hidden in genital papilla. No crest on head. Second dorsal spine strongly produced, $^{3}/_{4}$ to 1 times length of head. Anal pale, but usually showing at least trace of submarginal dusky band. . . . . 3b. *Andamia reyi,* female, p. 264.

1. **Andamia tetradactylus** (Bleeker) (Fig. 45, p. 260)

Salarias tetradactylus Bleeker, Nat. Tijdschr. Ned. Indie XV, 1858, p. 228.
Salarias aequipinnis Günther, Cat. Brit. Mus. III, 1861, p. 253.
Alticus tetradactylus Bleeker, Versl. Akad. Amsterdam (2) III, 1869, p. 235.

D. XVI-XVII. 17-18. A. II. 24. P. 15. V. I-4.

No crest on head in either sex. The top of the head flat or a little rounded, with no pit. Nasal cirrus tiny, simple, no longer than diameter of nasal pore. Supraorbital cirrus filamented on both sides, $^{2}/_{3}$ diameter of eye in length. Interorbital space about $1^{1}/_{2}$ to $1^{2}/_{3}$ times as wide as eye diameter. A sucker behind lower lip as in *A. heteroptera.* Both lips crenulate. Depth 9 to 10. Head 5.2 to 5.9. All dorsal spines (except last which is buried with only its tip showing), rays, and principle caudal rays with the membrane strongly excised between them and the tips free; second dorsal spine strongly extended in both sexes, a little longer than head in female, nearly twice length of head in male; no true notch in dorsal, only a change in level with the soft dorsal membrane edge becoming higher than spinous dorsal; last ray free of caudal. Spinous dorsal of male higher than that of female. Pectoral equal to or a little longer than head, rounded. Ventrals 2.2 in length of head, the first three rays heavy, the fourth somewhat smaller and hidden but more evident than usual in Salariin blennies. Head and body evenly dusky without transverse bands or blotches. Small white spots liberally scattered over top of head, back under spinous dorsal, and over all of body behind anus. Vertical fins uniformly dark, in males darker than body, except for white tips of anal rays. Anal all white and other fins lighter in female. Pectorals dusky with some indistinct white spots. Ventrals paler.

Habitat: West Biliton! Ambon!

Note: This species has been variously submerged in the synonymy of *Andamia heteroptera* or *Alticus saliens.* It is known only from Bleeker's type series (Leiden Museum 4780, from which the above description is drawn), and Günther's type series (British Museum 58.4.21.424), although others may have been reported as one of the other species noted above. The species agrees most closely with *A. reyi* in coloration, flatness of the top of the head, and the extended dorsal spines in both sexes. It is clearly defined from both other species of *Andamia,* however, by the higher number of dorsal spines, lower number of dorsal rays, and the prominent white spotting on the caudal portion of the body. From *A. reyi* it is further defined by the lack of crest on the head of the male. The types of Günther's *aequipinnis* are of this species, the only difference being that they have some plainly evident black, as well as white, spots on the side of the head and the white spotting posteriorly on the body is not evident.

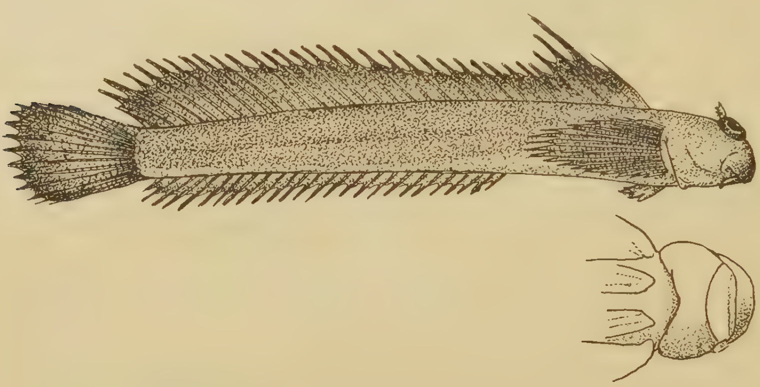

Fig. 45. *Andamia tetradactylus* (Blkr) × $1^1/_4$.

2. **Andamia heteroptera** (Bleeker)

Salarias heteropterus Bleeker. Acta Soc. Sc. Indo-Neerl. II, 1857, p. 65.
Andamia expansa Blyth, Journ. Asiat. Soc. Bengal XXVII (1858) 1859, p. 271.
Andamia expansa Day, Proc. Zool. Soc. London 1869, p. 518.

Alticus heteropterus Bleeker, Versl. Akad. Amsterdam (2) III, 1869, p. 234.
Andamia expansa Day, Fishes of India, Part II, 1876, p. 336.
Andamia heteroptera Day, Fauna Br. India, Fishes II, 1889, p. 323.
Andamia cyclocheilus M. Weber, Notes Leiden Mus. XXXI, 1909, p. 143 — Siboga Exp. Fische, 1913, p. 538.
Andamia heteroptera Annandale and Hora, Rec. Ind. Mus. XXVII, part II, 1925, p. 39.
Andamia heteroptera Mukerji, ibid. XXXV, 1932, p. 121.
Andamia heteroptera Giltay, Mem. Mus. Royal. Hist. Nat. V. Fasc. 3, 1933, p. 103.
Andamia cyclocheilus Herre, Philip. Journ. Sc. LIX, 1936, p. 370.
Andamia heteroptera Rao and Hora, Rec. Indian Mus. XL, Part IV, 1938, p. 396.
Andamia reyi (non Sauvage) Herre, Philip. Journ. Sc. LXX, 1939, p. 341.

D. XIV. 19-21. A. II. 24-25. P. 15. V. I. 4.

No crest on head in either sex. Nasal cirrus simple, pointed, and scarcely longer than diameter of nasal pore. Supraorbital cirrus about equal to diameter of eye in length, pointed, one or two small filaments on inner side and three or four larger ones on outer side. Snout evenly rounded and a little longer than diameter of eye. Head greatly flattened with cheeks bulging out as hemispheres; depth of head about $^1/_2$ its breadth. Interorbital space about $^2/_3$ to $^4/_5$ diameter of eye and deeply concave, the deepest point a broad pit behind eyes with a median groove running from this pit to base of dorsal and the top of head bulging on either side of this groove. Eyes project from dorsal outline to extent of half diameter of eye. Upper lip irregularly but strongly crenulate for whole length. Lower lip also crenulate, but even more irregularly than upper lip. A thin flap of skin extending back from lip to a length equal to diameter of eye and a breadth equal to lower lip, its posterior edge curled downward so that it, with the swollen edge of the lower lip, forms a crude suction pad. Depth of body 7.7 to 8.5. Length of head 5.6 to 6.0. Dorsal fin differing between sexes. *Male*: Edges of membrane of spinous part a little lower than that of soft part, but tips of spines extending far beyond membrane; first shortest, extending only half its length beyond membrane; second longest being nearly twice depth of body in length and having outer three-fourths of its length free from fin membrane; third considerably shorter than second; fourth and remaining spines a little shorter than third and all of about same length with result that actual height of spinous dorsal is somewhat higher than soft dorsal and membrane between spines is excised to a depth of $^1/_4$ the length of the spines. No actual notch between spinous and soft dorsal. *Female*: All dorsal spines approximately the same length (about half depth of body) with only tips free from membrane. Soft dorsal higher than spinous with a distinct jog, but no notch. Longest rays of female soft dorsal $1^1/_3$ height of body and proportionately a little lower than in male. Last ray completely free from caudal in both sexes. Half of anterior edge of each anal ray free of fin membrane in male, $^2/_3$ in female. Longest anal ray $^2/_3$ depth of body in male, $^1/_2$ in female. Anal spines of male distinct and only a little shorter than first ray. Both spines involved in the bulbous genital papilla of female; second only $^1/_3$ length of first ray, only tip of first spine visible. Tips of 12 principle caudal rays protruding from evenly rounded border of fin; lower 3 rays noticably thickened; caudal $^1/_3$ longer than head in male, $^1/_5$ longer than head in female. Longest pectoral ray equal in length to head, the fin rounded with the lower three rays somewhat thickened. First two ventral rays strongly thickened, stubby (the second, the longest, equal $^4/_5$ postorbital length of head); inner two rays, while only half the thickness of outer two, still large and apparent and not folded under two heavy rays as is usual in other Blenniidae having four ventral rays. The two inner rays only a little shorter than second ray, and in the female the third ray is even a little longer than the second.

Coloration differing between sexes. *Male*: Top of head more or less uniformly brown. Bulging cheeks, sides of head, area under eye, snout and upper lip variously and thickly marked with round and elongate dark spots on light background. Lower lip, sucker and throat pale and unmarked, as are ventral fins and ventral surface of body. Body dark above, light below, liberally applied with more or less vertical intrusions of light colour up on sides in form of numerous irregular, vermiculate lines that, toward caudal peduncle, break up into spots. No indication of regular vertical dark bands on body. Dorsal fin nearly black, with no markings except for narrow, silvery line ascending along following edge of each ray and spine. Caudal a little lighter basally but black distally, opaque, and without markings. Anal narrowly pale basally but otherwise black except for free tips, which are light. Base of pectoral thickly spotted with dark, like adjacent cheek, and these spots infringe on base of rays and cover dorsal third of fin. Other than this the fin is uniformly reddish brown and opaque. *Female*: Much more sombre than male. Top and sides of head, snout and body chocolate brown often with little indication of spots or markings. Throat, pelvics and ventral surface of body, while lighter than above, not strongly contrasting. Base of pectoral and upper third of fin spotted as in male, but dully. A light streak behind each dorsal spine and ray, but dark and light not strongly contrasting. Rays of caudal chocolate brown, but membrane clear and translucent. Anal entirely unpigmented and membrane translucent.

Habitat: East Ind. Archipelago (Bleeker types)! Celebes! — Andaman Islands! Philippine Islands! New Guinea!

Note: The type series (Leiden Museum 4779) consists of three specimens with heads detached, fins damaged, and otherwise in very poor shape. The big male has no crest on its head. However Bleeker's description is definitive, except for the sucker on the lower lip, which is still apparent on the types. *A. cyclocheilus* is simply the female of the species, the shape of its sucker not being out of the ordinary for the species.

3. **Andamia reyi** (Sauvage)

Salarias reyi Sauvage, Bull. Soc. Philom. Paris (7) IV, 1880, p. 219.
Andamia raoi Hora in Rao and Hora, Rec. Ind. Mus. Calcutta XL, 1938, p. 396, 398.

D. XIV. 20-21. A. II. 24-25. P. 15. V. I-4.

Much like *A. heteroptera,* except for the following: A triangular, very fleshy, lumpy crest on male as high as eye, and about same size. Top of head flat in female with no postocular pit or lateral bulges. Lips not so deeply or fully crenulate as in *heteroptera,* but no sharp distinction is possible. Eye is little larger and interorbital space often narrower, but not consistently so. Second dorsal spine of male $1^1/_2$ times length of head, or a little more; following spines all free from fin membrane by $^2/_3$ depth of body, or $1^1/_2$ times eye diameter. Second dorsal spine of female also extended, $^3/_4$ to 1 in length of head; remaining spines not extended or free from membrane. *Male*: Dark, slaty grey, lighter below. No dark spots on head or fin. A faint pale line, with 2 white spots in it, down from front of eye over upper lip. A narrow white line down from front of crest around back of eye to upper lip. Back tip of crest black. A few white spots on opercle edge and clustered around top of gill openings; 4 or 5 more scattered irregularly on back under first half of spinous dorsal. Traces of paired vertical bands on body, but not plain. Dorsal with traces of vertical white lines between spines and rays, otherwise generally dusky, darker than body. Anal with submarginal dark band; tips of rays and base pale. Caudal rays dark, the membranes clear. Pectorals and pelvics unmarked. *Female*: A rim of white spots all around the eye; numbers scattered over top of head, those on opercle and anterior part of body more numerous than in male. Anal paler than in male or *heteroptera,* but traces of submarginal dusky band even quite black and broad in specimens from Christmas Island.

Habitat: Andaman Islands! Christmas Island! Philippine Island.

Note: The diagnosis of Sauvage's *S. reyi* was so brief and generalized that the species was not recognized subsequently and the name was buried in the synonymy of *A. heteroptera.* An examination of Sauvage's type, a female 51.5 mm. long without caudal (Paris Museum 2201a), shows it to be precisely the species subsequently defined by Hora as *A. raoi.* The top of the head is not only level but there is a slight trace of a crest. The second dorsal spine is elongate and free distally; the rest of the dorsal spines low and normal. D. XIV. 20. A. II. 24. A prominent white dash behind eye and over upper lip; a white dot under eye ahead of this. Several (7 on left side, 4 on right) white dots on back between pectoral and dorsal. Three faint white dots on top of head. This species and the closely related *A. heteroptera* occur together, even on the same beach in the Andamans. The careful ecological observations of Rao and Hora (see above) indicate the slight differences in habitat occupied by these two similar species and lead the way for other studies of a similar nature on the numerous instances of two or three morphologically almost identical Salariin blenny species occupying the same geographical range or even the same tide pool.

The Christmas Island specimens are quite normal except that the white spots, so prominent in the other specimens, are here few in number and so faint that they might have been overlooked had not the other specimens been available.

4. **Alticus** C. V.

Alticus Lacepède, Hist. Nat. Poiss., II, 1800, p. 458 (from Commerson ms.); Cuvier and Valenciennes, Hist. Nat. Poiss, III, 1836, p. 337; Bleeker Versl. Akad. Amsterdam (2) III, 1869, p. 235.
Rupiscartes Swainson, Nat. Hist. Fishes, etc., II, 1839, pp. 79, 182, 275.
Basilisciscartes Fowler, Notul. Nat. Philad., XXVI, 1939, p. 2.

D. XIII-XVII. 17-24. A. II. 18-28. P. 15 (very rarely 14). V. I-4.

A well developed crest on male; female with or without crest. Nasal cirrus simple, pointed, shorter than pupil (except in *kirki*). Supraorbital cirrus filamented on both sides. No nuchal cirri. Upper lip crenulate or with an offset laterally so that middle of upper lip overlaps lower lip when mouth closed, but lateral quarters do not. Lower lip crenulate or smooth. A posterior canine in lower jaw (except in *kirki*). No vomerine teeth. Depth 6.0 to 8.0. Head 4.5 to 5.5. Lateral line limited to a few pores ahead of the level of the 7th dorsal spine, or absent. Dorsal with shallow but distinct notch, or at least a distinct change of level (in females) between low spinous, and higher soft, portions; dorsal completely free from caudal. No dendritic pads on anal spines of male; first anal spine of female hidden in genital papilla. Caudal with no branched caudal rays or with no more than seven, and those branched only toward tip in fully adult specimens.

Distribution: Indo-Western Tropical Pacific from East Africa to the Marquesas Islands and from Japan to Northern Australia. About eight species, with several sub-species.

Note: This natural assemblage of species represents quite a different line of development than those other genera of Salariin blennies having ventrals I-4 (*Ophioblennius, Cirripectus,* and *Entomacrodus),* differences that are pointed out by the arrangement and nature of the cirri; the diminished or absent lateral line, the decrease in number (or absence) of branched caudal rays and the presence of well defined crests on the males. *Andamia,* on the other hand, is merely a specialized extension of *Alticus* both in structure and habits. Toward the *bilineatus* end of the series it converges on *Salarias,* but it is easily told from that, perhaps complex, genus by the characters noted above. Three species have been taken in the Indo-Australian area; others can be expected.

Key to the Indo-Australian species of Alticus

A. Dorsal XIV-22 to 23; anal II-26 to 27. Both lips strongly crenulate along entire margin . . . . 1. *Alticus saliens* p. 266.
B. Dorsal XIII-17 to 21; anal II-19 to 21. Lower lip smooth or crenulate only in mesial half, with lateral quarters smooth.
  a. Upper lip always distinctly crenulate, at least on lateral quarters; upper lip not offset laterally, or only slightly so; fe-

males with, or without an occipital crest. which is flat, rounded, or triangular.

- a^1. Upper lip strongly crenulate across its entire length; lower lip crenulate in middle half; crest triangular coming to dorsal point, present in both sexes . . . . 2. *Alticus triangulus* p. 269.
- b^1. Upper lip crenulate only on lateral quarters and smooth or very faintly denticulate on middle half; lower lip smooth; no occipital crest in females. 3. *Alticus semicrenatus* p. 270

1. **Alticus saliens** (Forster)

Blennius saliens Forster, Itin. II, 1788, p. 343.
Blennius saliens Lacepède, Hist. Nat. Poissons II, 1800, p. 458, p. 479.
Blennius tridactylus Bloch Schneider, Syst. Ichth. 1801, p. 176.
Salarias alticus Cuvier and Valenciennes, Hist. Nat. Poissons XI, 1836, p. 337.
Blennius gobiodes Forster Lichtenstein. Descr. Animal. 1844, p. 283.
Salarias tridactylus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 242.
Salarias alticus Kner, Novara Exp. Fische I, 1865-1867, p. 196.
Salarias tridactylus Steindachner, Sitzber. Akad. Wien LVII. 2. Abth. 1868, p. 994.
Alticus tridactylus Bleeker, Versl. Akad. Amsterdam (2) III, 1869, p. 234.
Salarias tridactylus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 1189.
Salarias tridactylus Day, Fishes of India, Part II, 1876, p. 330.
Salarias tridactylus Günther, Fische der Südsee II, 1876, p. 200.
Alticus saltatarius Bleeker, Recherches Fauna Madagascar. 4e. Partie, Poissons, 1878, p. 74.
Salarias montanoi Sauvage, Bull. Soc. Philom. Paris (7) IV, 1880, p. 219.
Salarias sertatus Garman, Bull. Mus. Comp. zool. XXXIX, 1903, p. 237.
Alticus saliens Jordan and Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 421.
Salarias tridactylus Bean and Weed, Proc. U. S. Nat. Mus. XLII, 1912, p. 609.
?*Salarias andersoni* Delsman, Tropische Natuur. XIV, 1925, pp. 13, 14.
Salarias saliens Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 434.
Salarias saliens Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 412.
Salarias saliens Fowler, Monogr. Acad. Sc. Philadelphia II, 1938, p. 81.
Salarias saliens Herre, Rec. Indian Mus. XLI, 1939, p. 361.
Rupiscartes saliens L. P. Schultz. Bull. U. S. Nat. Mus. 180, 1943, p. 276.

D. XIV (rarely XIII or XV). 21-23. A. II. 24-27. P. 15. V. I. 4.

Crest well developed in male, triangular, sloping evenly up to its highest point over the posterior end of its base from which it drops straight to base, with no free posterior lobe; nearly as high as diameter of eye and $1^3/_4$ times as long as eye. No crest in females except in very large individuals where a low fleshy ridge, never as much as $^1/_2$ height of pupil, is sometimes developed. Nasal cirrus simple, pointed and minute; never more than $^1/_2$ the pupil diameter in large individuals. Supraorbital cirrus short and stubby, not greater in length than diameter of pupil, bearing on either side 2 or 3 stubby, simple filaments. Snout projecting, forehead receeding, mouth inferior. Both lips strongly crenulate along entire edges; several characteristic folds of membrane at corner of mouth when it is closed. Males with well developed, pointed, canine posteriorly on each dentary, fitting into cavity in roof of mouth when latter is closed. Depth 7.6 to 8.5. Head 5.1 to 6.1. Spinous dorsal somewhat higher than soft dorsal in males; anterior spines highest, the fin becoming lower posteriorly with a distinct, but shallow notch, between the fins. Notch scarcely noticeable in young males. Anterior dorsal spines not more than $^2/_3$ as high as body in females; last spine about $^1/_3$ height of first ray; no notch in membrane, merely a change in level with the soft dorsal the higher. Anal spines not markedly shorter than rays in male (first hidden in genital papilla in females); membrane deeply excised between rays. Last anal ray free from caudal peduncle. Longest pectoral ray as long as, or a little longer than, head; lower 2 to 5 rays (depending on age) thickened and fleshy. The stubby ventrals a little shorter than postocular length of head; the spine hidden, first two rays thickened and stout, third as long as second but not stout, fourth shorter and quite slender. Lower four rays of caudal thickened and fleshy, with lower three characteristically shortened as if ventral edge of fin had been clipped off. *Male*: Over all colour quite dark, with fins generally darker than body. Crest covered with large, round dark spots, larger and more widely spaced than those on cheek. These large dots extend down to the opercle and there are no vermiculations in this area or at the base of the crest. Lower cheek, operculum, snout, upper lip, base of pectoral, shoulder, area under pectoral and the light areas dorsally on the body thickly set with tiny dark dots. Upper cheek may be dotted or plain; dots not prominent on anterior part of body; those on upper lip and snout a little larger than those on cheeks. A white streak, narrowly margined with

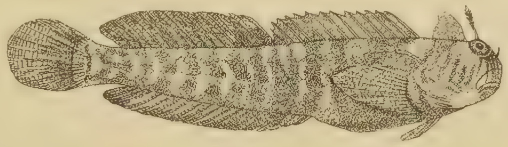

Fig. 46. *Alticus triangulus* n.sp. n.s.

black, curving around back of eye and down to, but not onto, upper lip a little ahead of corner of mouth. A similar streak runs from lower margin of eye to anterior nostril. A broad, lighter area descends from the end of the crest down over the operculum, branchiostegal rays and the back of the throat. Throat light with no markings. Eleven light spots the size of eye or smaller, either clear or containing a few dark dots, along the base of dorsal. Ten to 15 light vertical streaks spaced along the body, sometimes more or less faded and broken into oblong spots. These are the light areas between the double dark vertical bands which do not generally show up themselves because of the general darkness of the body. Both dorsals nearly black with a light streak ascending obliquely half way up fin from each of the pale spots at base of dorsal; traces of narrow, oblique, black lines on spinous dorsal. Anal dark with tips of rays light. Pectorals quite dark in some specimens, pale in others, marked only by fine black dots that extend out over a variable extent of fin, but never over more than basal half. Ventrals more or less dusky, but unmarked. Caudal dark but basal $^2/_3$ of membrane between rays clear and translucent; distal third pigmented and opaque. *Female*: generally same in coloration as male with following differences. Top of head spotted but these not so much larger than cheek spots as in male. A few dark spots anteriorly on body. Vertical dark bands of body generally distinguishable. Between each is a light band divided by a thin, vertical, dark line. Dorsals light basally, shading into a dark, submarginal band, with the tips of spines and rays pale. Anal pigmented except for tips of rays, but lighter than body.

Habitat: Banka; Java! (Palabuan Batu, Merak, Wijnkoop's Bay); Flores; Ceram — Samoa!, Tahiti!, New Hebrides!, Fiji!, Southern Japan!, Philippines!, India!, Christmas Island (Indian Ocean)!, Andamans!

Note: This is a wide spread species which is represented by a sub-species in the western Indian Ocean, whose synonymy is not included above, and by an undescribed sub-species in the Ryu Kyu's and southern Japan. *Alticus andersoni* Day is, at most, a sub-species of this form from southern India which is distinguished from the form described above only by the presence of a few scattered pores of a lateral line being apparent anteriorly. The specimens which have been listed as *saliens* in the literature from the Marquesas prove to be of quite another species. The type of *S. montanoi* Sauvage, upon examination, prove to be quite typical of the above form. The above description has been drawn from Samoan specimens, since only two old specimens were available from the East Indies (Java). The Java specimens fit the above description precisely except that the colour is somewhat faded.

2. **Alticus triangulus** new species. (Fig. 46, p. 267)

Salarias frenatus (not of Cuvier and Valenciennes) Herre, Rec. Indian Mus. Calcutta XXXXI, No. 4, 1939, p. 369 (Andaman specimens in part).

D. XIII. 17-19. A. II. 18-19. P. 15. V. I-4.

Both sexes bearing a high, conical crest on head, twice the diameter of eye high and half as long as high in large males; shorter and lower in females, but still triangular. Nasal cirrus simple, pointed but somewhat flattened and not rod-like, as long as pupil diameter; rarely one or two tiny nubbins at base of outer side. Supraorbital cirrus as long as eye, or a little shorter, tapering to a point and with 4 or 5 small, fleshy filaments on either side. No nuchal cirri. Snout projecting well before forehead. Upper lip strongly crenulate for its full length. Lower lip weakly crenulate in its middle half, smooth on lateral quarters. No offset on lateral quarters of upper lip. A strong, sharp, recurved canine as long as pupil posteriorly on each dentary, fitting into pit in roof of mouth. Depth 5.5 to 6.3. Head 4.1 to 4.5. Lateral line disappearing under 6th or 7th dorsal spine. Dorsal deeply notched, with last spine buried in fleshy membrane at base of first ray; last ray bound to caudal peduncle but completely free from secondary caudal rays. Longest pectoral ray a little shorter than head. Last anal ray free from caudal peduncle. Caudal with none of rays forked except in large specimens where three or four of the middle rays may be forked at tip; lower three principle rays shortened with the peculiar clipped appearance typical of *Alticus*. *Male*: Colour generally a rich brown relieved by light brown markings, and quite pale on abdomen. Twenty to 22 narrow, light, vertical lines over snout and upper lip, and extending back onto lower part of cheek. Throat uniformly dusky or with one white chevron anteriorly and faint traces of two others posteriorly. Crest with a faint vertical bar of darker pigment in its center. Base of pectoral dusky with a diffuse spot in its center and no sharp markings. Top of head and area at base of dorsal light brown with a few darker small spots. Seven to 10 irregular, slender bands of light brown extend up on side from light area of abdomen and along base of anal. Darker areas of sides broken up into irregular blotches by these and other diffuse lighter spots and markings. No sharply defined bars or spots on body. Dorsals almost black, relieved by diffuse lighter lines which noticeably slope posterodorsally on soft dorsal. Anal lighter proximally, shading into nearly black distally. Caudal with diffuse dark spot at base and dusky area terminally, but without sharply defined spots or markings. Pectorals and ventrals dusky, without sharply defined markings. Upper half of pectorals lighter than ventral half. Body side of ventrals darker than outer side. *Females*: Lighter in all parts than male, but markings substantially the same. Always a narrow, white chevron on throat near symphysis; a second, usually less well defined, behind it; and at least traces of a third farther back on the gill membranes. Anal pale, with a narrow, submarginal, dusky band which may be broken up into individual spots between tips of rays; tips of rays white. Ventrals white.

Habitat: Java! — Andamans! Burma!

Note: This well marked species has been variously confused in collections under the names *Salarias frenatus, S. meleagris, S. amboinensis* and *S. crenulatus*. It is described from the type, a male 66 mm. long, collected by Mukerji in the Andamans, 40 paratypes from the Andamans, 35 paratypes from Turtle Bay, South Island, Southern Muscos Group, Burma (all in the Stanford Natural History Museum), 1 paratype, a male 55 mm. long, collected by Kooiman, 1933, at Batoe Oelo, south coast of Java, and preserved in the Amsterdam Museum, and 1 paratype, a female 57 mm. long, collected by Van Hasselt in Java (Leiden Museum No. 1816).

3. **Alticus semicrenatus** new species.

Salarias (*meleagris* C. V.?) M. Weber, Siboga Exp. Fische, 1913, p. 535.

D. XIII. 18-19. A. II. 19-20. P. 15 (rarely 14). V. I-4.

Males with a prominent crest about $^2/_3$ diameter of eye in height and twice eye in length, nearly flat on top and both ends evenly rounded, without a free flap posteriorly. No trace of crest in females. Nasal cirrus simple, slender, pointed, and no more than $^2/_3$ pupil in length; supraorbital cirri varying in length from equal to eye diameter to $1^1/_2$ times eye; 10 to 12 filaments on either side and one or two at tip; main cirrus of equal width from base to near tip. No nuchal cirri. Forehead sloping back a little from the vertical. Upper lip and snout somewhat swollen and prominent. Upper lip crenulate in lateral quarters and entire in middle half. Upper lip not offset laterally and middle half not overlapping lower lip strongly when mouth closed. Lower lip smooth. A single canine on either side below, sharply pointed, nearly equal to pupil diameter in length, fitting into pit in roof of mouth. Depth 6.6 to 8.1. Head 4.1 to 5.1. Lateral line scarcely evident even anteriorly. Dorsal deeply notched with last spine hidden in membrane at base of first ray; last ray completely free from caudal. Longest pectoral ray equal to head in length. Last anal ray free from caudal peduncle. Six to 7 weakly forked caudal rays, never more. *Male*: Colour predominately dark brown with light areas showing up as stripes, spots, etc. A dark band extending from nostril across upper lip. Between these two on mid-line, a narrow light band. A broad light band dropping down from anterior edge of eye to lip, followed by a dark band of equal width from lower edge of eye, then another light band, and a third dark band from posterior edge of eye. A broad, light triangle from eye back over cheek, and above that a broad dark area. Anterior edge of crest light, followed by a dark area, then a light area near the middle, then a dark area which covers remainder of crest or leaves room for a light posterior edge. Throat with a small, dark triangle at symphysis; behind this a single, narrow, white chevron; behind this, central portion of gill membrane evenly dusky with the sharply defined dark and light bands continued onto throat from sides of head confined laterally and not meeting mesially as chevrons. A dark band across anterior part of pectoral base followed by a light area, then a dusky area at base of rays. Abdomen and narrow area along base of anal fin silvery white. From this area 10 to 12 narrow white bands, of which more than half are forked above, extend up beyond mid-line of side. Six light oval areas along base of dorsal, most of which are continuous with light bands on side. No small black spots on back. Spinous dorsal either uniformly dark or with a few indistinct postero-dorsally directed light bands, but without spots. Soft dorsal dark with numerous, oblique, narrow light bands, and with no spots. Anal rather pale proximally, shading into a dark margin. A large dark spot at base of caudal set off from dark of body by a light band. Rest of caudal uniformly dusky, with no spots or bands. Pectorals and pelvics uniformly dusky. *Female*: Coloration like that of male except markings of head and throat more sharply defined, pelvics pale, anal quite pale with only a slender, dusky, submarginal band and white ray tips beyond that.

Habitat: Celebes!, Waigeu!

Note: This clearly defined species has been confused in collections with *S. frenatus* and *S. meleagris*. Described from the type, a male 46 mm. long, collected by Herre at Lembeh Straits, Celebes, 17 paratypes from the same collection (Stanford Natural History Museum, 29487), and 2 paratypes collected by Weber at Waigeu, and preserved in the Amsterdam Museum.

5. **Entomacrodus** Gill

Entomacrodus Gill, Proc. Acad. N. S. Philad. XI, 1859, p. 168.
Salariichthys Guichenot, Mem. Soc. Sci. Nat. Cherbourg, xiii, 1867, p. 96.

D. XIII (rarely XIV). 13-18. A. II. 14-18. P. 14 (rarely 13). V. I-4 .

No crest on head in either sex (except in *stellifer* and very large specimens of *decussatus*). Nasal cirrus with several filaments. Supraorbital cirrus with secondary filaments (except in *stellifer* and *lighti*). Nuchal cirrus always present, double on each side in *marmoratus*, single on each side in other species; simple or multified. Forehead usually rounded, sloping back from a vertical from the snout. Upper lip strongly crenulate (weakly in *decussatus* and completely smooth in *thalassinus*) either laterally, mesially or along entire length. Lower lip smooth. A single canine posteriorly on each dentary; none above. A single row of 6 to 10 tiny, conical teeth across head of vomer. Teeth in both jaws very flexible, more than 150 in each jaw, typically Salariin. Depth 4.4 to 6.4. Head 3.6 to 4.6. Lateral line a single series of pores curving down under the distal part of pectoral to middle of side and either disappearing there or continuing to base of caudal as a line of isolated, indistinct pores. Spinous dorsal lower than soft; last spine normally tiny, recurved, stout and buried in membranes at base of deep notch between spinous and soft dorsal; last rays usually free from first tiny rays of caudal, (except in *decussatus, lighti* and *striatus*). Longest pectoral rays usually shorter than head by length of snout. Spine of ventral stout but hidden; first two rays heavy; last two rays slender, last tiny, usually folded under larger rays and not evident. Spines of male anal readily apparent, they and first few rays of anal often swollen and somewhat rugose in large specimens, the spines provided with definite dendritic masses in *thalassinus* and large *caudofasciatus*; first spine of female anal hidden in genital papilla; membrane deeply excised between rays; last ray free from caudal peduncle except *lighti* and *stellifer.* Middle 9 caudal rays always deeply branched, even in young.

Habitat: Tropical Indo-Western Pacific from Africa to Easter Island and from Japan to Australia. Tropical Eastern Pacific. Tropical Atlantic from Panama to Africa. About 12 species.

Note: This genus has formerly been confined to a single species from the tropical Atlantic and eastern Pacific, characterized from other Salariin blennies by the presence of a row of vomerine teeth. Examination of Indo-Western Pacific forms revealed a number of species which shared this character, had the ventrals I-4, and had the above-noted characters in common. Indeed one of the Indo-Western Pacific species, *caudofasciatus,* could scarcely be defined from the Atlantic *textilis* on morphological grounds.

The presence of four rays in the ventral fin, teeth on the vomer, the posterior canine teeth in the lower jaw, and the normal 9 branched caudal rays, and the world wide distribution in spite of not having a prolonged pelagic post-larval stage, all indicate that this genus is close to the basic tropical blenny stock. There are no specializations as in the other Salariin genera having the ventrals I-4 (*Cirripectus, Ophioblennius, Andamia,* and *Alticus*); the general characters of body, dentition and fins are not dissimilar from the main group of *Salarias,* which is confined to the tropical Indo-Western Pacific.

Key to the Indo-Australian species of Entomacrodus

A. Supraorbital cirrus simple; middle half of upper lip strongly crenulate but lateral quarters smooth; nasal cirrus with a broad, flat, thin, central plate which has a few tiny filaments on either side; a prominent dark spot as large as pupil on membrane first two dorsal spines. 1. *Entomacrodus lighti* p. 275.

B. Supraorbital cirrus always with some filaments on inner side and often some on outer side; upper lip strongly crenulate on its lateral quarters except in *decussatus* (where it is weakly crenulate all the way across) and *thalassinus* (where it is smooth all the way across); nasal cirrus consisting of a short, rod-like pedicle with another short rod at its end, at right angles to pedicle, which bears several slender filaments palmately on its upper side; no prominent dark spot on membrane between first two dorsal spines

a. Last dorsal spine $^{2}/_{3}$ to $^{3}/_{4}$ the length of the next preceding spine; membrane from last dorsal ray covering first small rays of caudal; pectoral with dusky crescent across base of rays and two irregular rows of dark spots across outer part of fin; depth of body 4.4 to 4.6 . . . . 2. *Entomacrodus decussatus* p. 277.

b. Last dorsal spine minute, no more than $^{1}/_{4}$ length of next preceding spine, buried at bottom of dorsal notch; dorsal completely free from caudal, ususally a space between membrane from last dorsal ray and first small caudal rays; no dark spots on pectoral; depth of body 5.0 (usually 5.5) to 6.4.

  a^1. Upper lip strongly crenulate along its lateral quarters but smooth (or weakly and irregularly crenulate) along its median half . . . . 3. *Entomacrodus caudofasciatus* p. 279.

  b^1. Upper lip strongly and evenly crenulate along its entire length, from corner to corner.

    a^2. Nuchal cirrus single on each side but with five or six secondary filaments, one or two of which may be bifid; supraorbital cirri without secondary filaments on outer sides; snout and upper lip crossed by numerous narrow, vertical, alternate dark and light bands . . . . 4. *Entomacrodus epalzeochilos* p. 281.

    b^2. Nuchal cirrus single, simple, filiform; other characters as noted below.

      a^3. Body with an irregular double or triple row of prominent black or dark brown spots, varying from size of pupil to smaller, horizontally on middle of side from under pectoral to caudal, spots sharply defined even in faded specimens, usually numerous smaller dark spots above and below these spots; normal vertical body bands obscured by these spots; 5 to 8 sharply defined, dark, transverse bands across caudal; alternating, narrow light and dark bands of spots on dorsal clearly defined. Depth 6.0 to 6.4 . . 5. *Entomacrodus striatus* p. 283.

b^3. Body without black or dark brown spots, covered everywhere except abdomen with small white dots or vermiculations; 6 broad, vertical, dark bands, rather obscure, on sides of body, extending down from base of dorsal to well below middle of sides, single above, all but last forked below; caudal crossed by numerous fine, vermiculate, brown lines enclosing light spots; spinous dorsal mottled with vermiculations and without distinct dark spots or pattern; soft dorsal also mottled but with numerous fine, oblique dark lines. Depth 4.9 to 5.3 . . 6. *Entomacrodus vermiculatus* p. 285.

1. **Entomacrodus lighti** (Herre)

Salarias lighti Herre, Proc. Biol. Soc. Wash. LI, 1938, p. 65.
Salarias marmoratus (not of Bennett) Herre and Myers, Bull. Raffles Mus. Singapore XIII, 1937, p. 48.

D. XIII. 15. A. II. 16 or 17. P. 14 (occasionally 15). V. I-4.

No crest in either sex. Nasal cirrus larger than pupil, $1^1/_2$ times as long as broad, with a broad, thin, central plate which tapers to a point and has 4 or 5 tiny filaments on either side of its base and one or two farther up on each side. Supraorbital cirrus varying from a little longer than eye to twice diameter of eye in length; slender, simple and tapering to a fine point (that of left side of Singapore male has a long fine filament coming off outer side near distal end). Nuchal cirrus simple, pointed, and about half diameter of pupil in height. Contour of head evenly rounded from occiput to upper lip. Region behind eyes, and cheeks, noticeably swollen. Middle half of upper lip strongly crenulate; lateral quarters smooth or only slightly wavy. A tiny, posterior canine in lower jaw, scarcely projecting from membranes. Depth 4.5 to 5.2. Head 4.0 to 4.5. Lateral line sharply arched and ending at a vertical from 12th dorsal spine. Soft dorsal a little higher than spinous dorsal; membrane attaching last dorsal ray to caudal peduncle extending over first small rays of caudal. Tips of anal rays of male somewhat swollen and bulbous, but not crenulate; last anal ray partially attached to caudal peduncle by membrane which leaves outer half of ray free. Longest pectoral ray equal to head in length. *Male*: Coloration generally pale olive gray. Three broad, dusky bands radiate from eye; posterior one over cheek shortest and broadest; one from eye to posterior corner of mouth longest and narrowest; a broad, indistinctly defined band from front of eye to upper jaw. No other distinct markings on head; cirri same dusky colour as rest of head. An indistinct, short, dusky bar on throat angling from corner of jaw out onto branchiostegal membrane; a very indistinct dusky, triangle at symphysis of lower jaws. Seven broad, dark, vertical bands on body; first 6 more or less double, extending briefly onto base of dorsal. Body otherwise pale cream; without markings. Lower half of body entirely pale. A sharply defined dark spot larger than pupil on membrane between first two dorsal spines. Both dorsals with indistinct, wavy, dark bands which ascend obliquely upward. No other spots or markings on rather dingy dorsals. Caudal with no spots or markings, but more dusky in middle than around edges. Anal pale proximally, quite dusky distally, but without spots or sharp markings. Pectorals and pelvics pale, without spots or markings. *Female*: Dusky triangle at symphysis of lower jaw distinct and elongated posteriorly; thin, light band separating it from dusky band at angle of jaw, which meets its counter-part of other side on mid-line of throat. Behind this a less distinct, light band, and remainder of the throat evenly dusky. Base of anal pale, a submarginal dusky band, and tips of rays clear, creamy white.

Habitat: Singapore! Amoy, China!

Note: This species is closely related to *stellifer* of southern Japan. The two are known from the remainder of the genus by the smooth corners of the upper lip, peculiar nasal cirri, simple supraorbital cirri, partial attachment of last anal ray, spot between first dorsal spines, etc. It is probable that their nearest relative is *decussatus* with which they share the deep body, partial attachment of dorsal to caudal, etc.

2. **Entomacrodus decussatus** (Bleeker)

Salarias guttatus (not of Cuvier and Valenciennes) Bleeker, Nat. Tijdschr. Ned. Ind. XIII, 1857, p. 379.
Salarias decussatus Bleeker, Nat. Tijdschr. Ned. Ind. XV, 1858, p. 230.
Salarias decussatus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 240.
Salarias aneitensis Günther, Jour. Mus. Godefroy XIII, 1877, p. 205.
Salarias aneitensis Jordan and Seale, Bull. U. S. Bur. Fish. XXV, (1905) 1906, p. 423.
Salarias aneitensis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 436; — Occ. Pap. B. P. Bishop Mus. IX (18), 1932, p. 15; — Proc. U. S. Nat. Mus. LXXXI (8), 1932, p. 7; — Mem. B. P. Bishop Mus. XI (6), 1934, p. 445.
Salarias marmoratus (not of Bennett) Herre, Philip. Jour. Sci. LXX (4), 1939, p. 361 (Nasugbu specimens, in part).
Salarias aneitensis Herre, Philip. Jour. Sci. LXX (4), 1939, p. 362.
Salarias aneitensis Schultz, Bull. U. S. Nat. Mus. 180, p. 284.

D. XIII. 16-18. A. II. 18. P. 14. V. I. 4.

No crest on head in either sex, but in large individuals a raised ridge, no higher than broad, apparent. Nasal cirrus a short stalk bearing 5 or 6 filaments palmately at its end; no longer than pupil diameter. Supraorbital cirrus broad, tapering to a point, not more than $^2/_3$ diameter of eye in length, bearing 4 or 5 filaments on both inner and outer side. Secondary filaments on both nasal and supraorbital cirri not developed on specimens less than 20 mm. long, but definable on specimens 25 mm. long. Nuchal cirrus simple, pointed, and no longer than pupil. Anterior profile nearly vertical, with forehead only slightly recessive. Upper lip shallowly crenulate for full length except directly in corners. A single, tiny, straight canine tooth on either side below, not fitting into cavity in roof of mouth but projecting sidewise into oral cavity. Depth 4.4 to 4.6.

Head 3.6 to 4.1. Dorsal deeply notched but last spine $^2/_3$ to $^3/_4$ length of next preceding spine; last spine readily apparent in half-grown and small specimens but more or less buried against leading edge of first ray in large specimens; soft dorsal about twice height of spinous dorsal; last dorsal ray bound to caudal peduncle by a membrane which reaches over first small rays of caudal but not to first principle ray. Longest pectoral ray equal to length of head. First anal rays of male not especially elongate or otherwise modified. Last ventral ray tiny, hidden and scarcely apparent in young but always present upon dissection, and readily apparent in older specimens. *Male*: Ground colour light olive in young but duskier in large specimens. Markings dark brown, sharply contrasting with ground colour, in young but nearly obscured by general melanism in large specimens. A broad V at nape and a small dark spot behind each eye on top of head; two small black spots below each of these on upper cheek, one on margin of orbit, other below nuchal cirrus; other fine black dots variable in occurrence on upper cheek in young, sprinkled densely all over head in old specimens. A broad, indistinct, light band from bottom of eye across lips at corner of mouth; lips and throat otherwise uniformly dusky and without markings. Markings of body varying with age but always following a characteristic pattern. Six vertical dark bands on side; first single and poorly developed; last, on caudal peduncle, single; remainder double, or nearly double, arranged as follows: A pair of round dots at dorsal edge of body, each sending a dusky streamer up on dorsal fin; these followed ventrally, after a clear area, by another dark spot which may be double or, if single, encloses a large, oval, light area; after another clear area ventrally occurs a double dark spot on ventral edge of body, which may be more or less joined to enclose light spots. As specimens grow larger the pairs of dark dots in these vertical bands are joined together by horizontal black lines

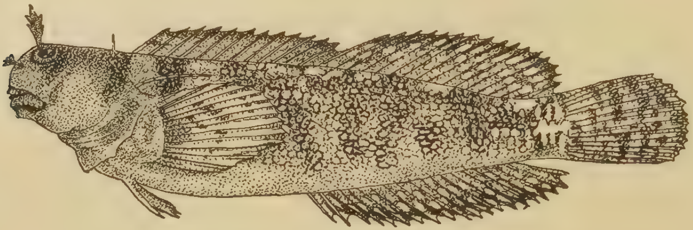

Fig. 47. *Entomacrodus vermiculatus* (C. V.) n.s.

which, with the vertical bands, form characteristic cross hatch markings on the body; in big specimens over 110 mm. long the vertical bands become almost completely obscured, leaving only the black horizontal lines on body which, themselves, sometimes become almost obscured by the general melanism of the older specimens. Horizontal lines often irregularly bifurcated and joining each other. Abdomen and a narrow band along base of anal fin light, unmarked. Both dorsals dusky; 1 or 2 small black spots on each ray and spine which, in large specimens, are more or less joined together by dusky bands with light stripes in between them, which are oblique on soft dorsal. First anal spine light; each anal ray with three large dots or the fin dusky with only dark mottlings visible and the tips of the rays light. Two dark spots at base of caudal; behind this three or four dark cross bands, wider than light interspaces; cross bands may be broken up into dark spots on rays. A dusky vertical streak across base of pectoral; a dusky crescent across base of pectoral rays and two irregular rows of dark spots across fin. Ventrals dusky, on body side, but light ventrally and unmarked. *Females*: Colour as in males.

Habitat: West Biliton! — Philippines! Aneitum! Tonga Islands! Samoa!

Note: The shift in prominence, during growth, of the vertical and horizontal dark lines on the body of this species causes the young, middle-sized, and large specimens to look quite different superficialy. Bleeker's specimens were of moderate size (40 to 110 mm.) and his colour notes were drawn from his smaller specimens. Günther's specimens were large (107 to 125 mm.) and his colour notes were drawn from his largest specimens. Comparison of these types with the large series obtained by Schultz in Samoa (16 to 84 mm.) makes it possible to bridge all the gaps in the colour pattern changes. The poor development of the canines, the greater number of rays in the dorsal and anal fins together with the slight attachment of the soft dorsal to the caudal, and the weak crenulation of the upper lip mark this species as somewhat of a transition between *Entomacrodus* and *Salarias* leading, perhaps, toward such species as *S. edentulus.*

3. **Entomacrodus caudofasciatus** (Regan)

Salarias caudofasciatus Regan, Proc. Zool. Soc. London, 1909, p. 405.
Salarias marmoratus (not of Bennett) Herre, Philip. Jour. Sci. LXX, (4) 1939, p. 361 (Nasugbu specimens in part).

Salarias periophthalmus (not of C. and V.) Herre, loc. cit., p. 352 (Dumaguete specimens in part).

Salarias thalassinus (not of Jordan and Seale) Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 283 (Swains Island and Tutuila specimens in part).

D. XIII. 14-15. A. II. 16. P. 14. V. I. 4.

No trace of crest in either sex. Nasal cirrus as long as, or longer than, pupil, consisting of 4 to 6 slender filaments borne palmately on end of short pedicle. Supraorbital cirrus a little longer than eye in adult, shorter in young; slender, tapering to point, with 4 or 5 slender filaments from basal half of inner side, rarely a single tiny filament distally on outer side. Nuchal cirrus simple, slender, pointed, and shorter than pupil in adults. Cirri do not take on adult form until specimen is 25 to 28 mm. long, but supraorbital and nasal cirri multifid at length of 18 mm. Anterior profile nearly vertical, but forehead not projecting. Lateral quarters of upper lip strongly crenulate with 5 to 10 deep crenulations on either side; middle half of upper lip either completely smooth or with faint indications of 2 to 4 widely spaced notches. A sharply pointed, slightly curved canine nearly as high as diameter of pupil on each dentary posteriorly. Depth 5.0 to 5.7. Head 3.9 to 4.4. Soft dorsal considerably higher than spinous part. Last dorsal spine $^2/_3$ length of next but often so buried in membranes of notch as to not be apparent without dissection. Dorsal notch deep and narrow; last ray completely free from caudal. Longest pectoral ray ranging from shorter than head by the snout and half the eye to shorter by only half length of snout. Anal spines and first 2 or 3 rays of male swollen at tip where each bears a somewhat furrowed, fleshy pad; last rays free from caudal peduncle. *Male*: General tone ruddy tan. A vertically oblong black spot behind eye, scarcely as high as eye, behind eye by less than pupil diameter. Three or 4 small, round, sharply defined white spots under eye. No other markings on head or throat. Throat uniformly pale. A sharply defined black spot as large as eye above and behind pectoral fin. Remainder of vertical body bands rather faint, although distinguisable, and without black spots. Body covered with well-spaced, sharply-defined, white spots of small size which may be round or longitudinally elongate and which fall into about five irregular longitudinal rows. Abdomen pale. Spinous dorsal dusky, without definite markings. Soft dorsal dusky with faint indications of light, oblique marks. Anal dusky with tips of rays sharply black anteriorly, shading off to dusky on posterior ones. Spine pads pale. Caudal crossed by 4 broad bands of dark, with narrower, lighter bands between; no spots. Pectorals and ventrals unmarked. *Female*: All fins lighter, especially anal, where duskiness is confined to a submarginal band, and tips of rays are light. Individuals of both sexes under 25 mm. in length have no pigmentation save for black spot above pectoral, 5 or 6 small black spots on peritoneum below pectoral, and one behind base of pelvic.

Habitat: Christmas Island (Indian Ocean)!; Philippines!; Marianas!; Samoa!; Swain's Island!.

Note: The colour notes on the adults above were drawn from the type specimens. The colour pattern of the Philippine, Micronesian and Polynesian adults varies in some details from the Christmas Island ones. This species is poorly distinguished morphologically from *E. textilis* of the tropical Atlantic and its cognate, called *E. chiostictus*, of the eastern tropical Pacific. The differentiation can only be made securely from the differenecs in colour pattern. This is the only Salariin blenny which has a close relative in the Atlantic and eastern tropical Pacific. The genus *Entomacrodus* was based on *nigricans* (= *textilis*).

4. **Entomacrodus epalzeochilos** (Bleeker)

Salarias marmoratus (not of Bennett) Cuvier and Valenciennes, Hist. Nat. Poiss. XI, p. 305 (Ceylon spec.).
Salarias marmoratus (not of Bennett) Bleeker, Verh. Bat. Gen. XXV, 1853, p. 50 (Ceylon Spec. only; compiled).
Salarias epalzeocheilos Bleeker, Nat. Tijdschr. Ned. Ind. XIX, 1859, pp. 333 and 344.
Salarias epalzeorhynchus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 240 (compiled; misspelled).
Salarias marmoratus (not of Bennett) Day, Fishes of India, p. 335 (Ceylon specimens only).
Salarias epalzeochilus M. Weber, Siboga Exp. Fische, 1913, p. 527 (compiled).
Salarias frenatus (not of C. and V.) Herre, Rec. Ind. Mus. XLI (4), 1939, p. 369 (Andaman specimens in part).

D. XIII. 15. A. II. 16. P. 14. V. I. 4.

No crest in either sex. Nasal cirrus no longer than pupil, consisting of 5 to 7 slender filaments borne palmately on a short, stocky, pedicle. Supraorbital cirrus from $1^1/_2$ to $1^2/_3$ times eye diameter in length, increasing in length with age, and males with longer cirri than females; rod-like, tapering to fine point; 5 or 6 long, slender filaments on basal third of inner side, none on outer side. Nuchal cirri with 5 or 6 filaments, one or two of which may be bifurcate, on a very short stalk; never more than one stalk on either side of nape. Forehead evenly rounded and not projecting. Upper lip strongly crenulate from corner to corner. Posterior canine on dentary. Depth, 4.8 to 5.0. Head 3.7 to 4.4. Dorsal deeply notched; the last spine tiny and hidden in bottom of notch; last ray completely free from caudal. Longest pectoral ray shorter than head by length of snout. Anal spines and rays of male not modified; last ray free from caudal peduncle. *Male*: Over all coloration varying from dark brown to light tan, with dark markings more prominent on latter. A sharply defined, narrow, slightly oblique black dash, a little longer than eye, behind eye. Thirty to forty narrow, vertical, alternately dark and light bands across upper lip and snout; these more or less obscured on upper part of snout and under eye by numerous small, brown spots. In light specimens these spots cover remainder of cheek, top of head, nuchal region, and extend in a narrow area back along lateral line. In dark specimens a light band descends around posterior border of eye and drops to corner of mouth. A dark spot on throat at symphysis followed by a white chevron; this followed by a dark Y-shaped chrevon; behind this middle of throat white with three more pairs of white chevrons (alternating with dark) which fuse with median white area. No auxiliary white spots on throat. Diffuse remnants of about six pairs of dark vertical bars on sides; none of markings sharply defined; no black spots as in *E. striatus*, and in melanistic specimens dark markings are scarcely visible except on caudal peduncle. Dark specimens have numerous, poorly defined, small, light dots on sides arranged in 3 or 4 irregular horizontal rows. Abdomen and ventral edge of body white to silvery. Dorsals irregularly mottled with diffuse dark and light markings which make more or less alternating oblique lines on soft dorsal. Anal light proximally, shading into quite dark distally, without markings. Two basal dark spots on caudal and 3 or 4 diffuse bands of spots across caudal; spots not small and sharply defined as in *E. striatus*. A dark, vertical bar across pectoral base at base of lower rays; base otherwise uniformly dusky (dark specimens) or with small brown spots (light specimens); lower $^2/_3$ of fin dusky, upper third lighter; no markings on fin except indications of a few light spots. Pelvics white ventrally; darker near body. *Female*: Like male; fins generally lighter.

Habitat: Batu Ulo, south Java! — Andaman Islands! Travancore and Vizagapatam, South India!, Ceylon!, Samoa!

Note: The type of *E. epalzeochilos* is apparently lost, at least there is no record of it in the Leiden Museum, nor in the museums of London, Paris and Amsterdam. The description is definitive, however, and an unpublished colour plate of the species made under Bleeker's direction exists at the Leiden Museum which agrees with the specimens here described. This species, beginning with Cuvier and Valenciennes, has been confused with *E. marmoratus*. *E. marmoratus*, besides differences in colour pattern, always differs from this species in having two separate nuchal cirri on either side of the nape and in having as many filaments on the outer as on the inner side of the supraorbital cirrus; no specimens of it taken elsewhere than in the Hawaiian Islands has been seen by me.

5. **Entomacrodus striatus** (Quoy and Gaimard)

Salarias striatus Quoy and Gaimard in Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 309.
Salarias arenatus Bleeker, Nat. Tijdschr. Ned. Ind. VIII, 1855, pp. 169, 170, 171, 173; — loc. cit., p. 448; — loc. cit., XV, 1858, p. 460; — loc. cit. XIX, 1859, p. 331; — Act. Soc. Sci. Indo-Neerl. VIII, 1860, p. 43; — Versl. Akad. Amsterdam (2) II, 1868, pp. 284, 288.
Salarias arenatus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 249 (compiled).
Blennius marmoratus (not of Bennett) Gray, Descr. Cat. Spec. Roy. Coll. Surg., 1859, p. 43.
Salarias marmoratus (not of Bennett) Herre, Philip. Jour. Sci., LXX (4), 1939, p. 361 (Waigeu specimens only).

D. XIII. 15-16. A. II. 16-17. P. 14. V. I. 4.

No crest on head in either sex. Nasal cirrus about equal to pupil diameter or less in length consisting of a short pedicle bearing 4 to 7 filaments palmately at its end. Supraorbital cirrus about $^2/_3$ diameter of eye; several filaments on inner side of cirrus and generally restricted to its basal half; none on outer side. Nuchal cirrus simple and about equal to pupil, or less, in length. Forehead receding; snout prominent. A single, recurved, sturdy canine as long as pupil posteriorly on dentary. Depth 6.0 to 6.4. Head 4.0 to 4.4. Dorsal deeply notched; last spine tiny but visible; last dorsal ray bound to caudal peduncle by a membrane which may not quite reach first caudal rays or may extend over all of first small caudal rays (in larger specimens). Anal spines of large males (over 65 mm. long) and first 3 to 5 rays bearing dendritic rugosities; smaller males either not showing this development or showing it imperfectly. First anal spine of females completely hidden in genital pad, and second almost hidden; last ray free from caudal peduncle. Longest pectoral ray shorter than head by length of snout. *Female*: A dusky spot behind eye; head otherwise sanded with brown specks on sides, top, under eye, on snout and upper lip, and with no indication of other dark spots or stripes. An indication of a broad silvery spot on lower cheek under this sanded area, and two or three tiny, silvery dots under eye. Throat with 4 pairs of narrow dark lines arranged in chevron-shape, the first pair joined and Y-shaped, the other pairs not meeting on mid-line of throat; space between chevrons more or less silvery. Vertical body bands fairly well defined both dorsally and ventrally; strongly forked ventrally. Abdomen and ventral edge of body posteriorly silvery, this silvery area extending up between ventral forks of body bands. Numerous round black spots on sides, equal to diameter of pupil or smaller; those concentrated into a prominent band along middle of side; smaller and generally grouped together in patches under dorsal; fewer and more scattered ventrally over anal; no smaller anteriorly than elsewhere. A prominent black spot $^2/_3$ the area of eye over pectoral axil, which is unequally split by a narrow, vertical, white line. Pectoral base evenly dusky and unmarked except for the intrusion of two silvery areas from the throat on its ventral edge. Dorsals with clearly defined oblique dark lines. Caudal crossed by 4 broad, dark bands, broader than light interspaces. Anal with little pigment, concentrated in a weak submarginal band. Pectoral evenly sanded with dusky pigment; no spots or markings. Pelvics pale. *Male*: As above except the anal more heavily pigmented, and there are traces of vertical lines on the upper lip.

Habitat: Waigeu! Cocos Island; Java; Solor; Sumatra? — Mauritius! Bombay! Seychelles! Ceylon!; Travancore and Vizagapatam, South India; Andamans; Philippines!; Japan!; Micronesia!; Polynesia!; Melanesia!

Note: This species has been frequently reported as *S. marmoratus*, and described as new under other names. It occurs throughout the Indo-Western Pacific faunal area and some sub-species can be recognized. Only the synonymy of the Indo-Australian archipelago form is listed above. None of Bleeker's specimens of this form from that area are extant; only a single female 29 mm. long collected by Herre at Waigeu is available. It can be differentiated from the form occurring through Polynesia, Micronesia, the northern Philippines and southern Japan by the fact that it has no filaments on the outer side of its supraorbital cirri and has a prominent black blotch over the pectoral axil. From the form found in southern India and the eastern Indian Ocean described by Cuvier and Valenciennes as *S. frenatus,* it can be told by the presence of the black blotch over the pectoral axil and the fact that the black spots on the sides of the body do not grow markedly smaller anteriorly. It should be noted that the *frenatus* form is likely to be found along the southern Java and the south west Sumatra coast; no specimens of the species are available from there at the present writing. The specimen from Waigeu appears to fit Bleeker's description of *arenatus* closely; a small male 27 mm. long collected by the writer at Munda, Solomon Islands does also. The above description is drawn from these two specimens. Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, p. 20, synonymized his *arenatus* with *striatus* after the examination of specimens of typical *striatus* from Mauritius, in the western Indian Ocean. Except for the fact that the form known as *S. frenatus* occurs geographically between them this action would be unquestioned. That all three forms are con-specific is without question. It is likely however that they can be considered as three sub-species of *striatus.*

Sauvage (Hist. Nat. Poiss. Madag., 1891, p. 385) differentiated *striatus* from *frenatus* on the fact (besides colour pattern differences) that *striatus* had the "lèvre supérieure entière" in contrast to the crenulation of the upper lip in *frenatus.* A re-examination of the types of *S. striatus* (Paris Museum N. 1796A) shows the upper lip to be crenulate from corner to corner. The upper lip in all three specimens is so wrinkled that this could be easily overlooked if proper magnification were not available.

The differentiation of *striatus* from *marmoratus* is rendered easy by the multiple nuchal cirri in the latter and the simple nuchal cirri in the former, as well as by the lack of prominent black spots on the side in the latter, and other differences in the colour pattern of the two species.

6. **Entomacrodus vermiculatus** (C. and V.) (Fig. 47, p. 278)

Salarias vermiculatus Cuvier and Valenciennes, Hist. Nat. Poiss., XI, 1836, p. 301.

Salarias vermiculatus Bleeker, Verh. Bat. Gen. XXII, 1849 pp. 6, 7, — Nat. Tijdschr. Ned. Ind. I, 1850, pp. 238, 241; — loc. cit. XV, 1858, p. 404; — Act. Soc. Sc. Indo-Neerl. VIII, 1860, p. 44.

Salarias vermiculatoides Bleeker, Nat. Tijdsch. Ned. Ind. XIII, 1857, p. 478; — Act. Soc. Sc. Indo-Neerl. III, 1858, p. 40; Nat. Tijdsch. Ned. Ind., XV, 1858, p. 404; loc. cit. XIX, 1859, p. 333; — Act. Soc. Sc. Indo-Neerl., VIII, 1860, p. 44.

Salarias vermiculatoides Günther, Cat. Fish. Brit. Mus., III, 1861, p. 239. (listed as doubtful species).

Salarias vermiculatus Günther, Cat. Fish. Brit. Mus., III, 1861, p. 249. (compiled).

Salarias vermiculatus Bleeker, Poissons Madagascar, 1875, p. 74.

Salarias vermiculatus Day, Fishes India 1876, p. 335.

Salarias vermiculatus Sauvage, Hist. Nat. Poiss. Madagascar, 1891, pp. 386, 522.

Salarias vermiculatus M. Weber, Siboga Exp. Fische, 1913, p. 528.

Salarias vermiculatus Hora and Mukerji, Rec. Ind. Mus. Calcutta XXXVIII, 1936, p. 20.

Salarias vermiculatus Herre, Rec. Ind. Mus. Calcutta, XXXXI (4), 1939, p. 364.

D. XIII (rarely XIV). 15-16. A. II. 18. P. 14 (rarely 15). V. I. 4.

Crest on head barely noticeable as a low ridge, not as high as wide. Nasal cirrus of 4 to 10 simple filaments arranged palmately at end of short pedicle. Supraorbital cirrus nearly as long as eye, pointed, with 4 to 12 simple filaments on either side of cirrus, arranged evenly along cirrus and not bunched at its base. Nuchal cirrus single on either side, slender, pointed, about equal in length to diameter of pupil, either simple or with one short sub-filament, but never with a group of filaments. Forehead evenly rounded. Pupil somewhat oval and slanting downward. Upper lip strongly crenulate for entire length, but crenulations smaller toward corners of mouth. Canine tooth posteriorly on dentary blunt, stout, about $^1/_2$ pupil in length. Depth 4.9 to 5.3. Head 4.3 to 4.7. Lateral line curving down behind pectoral and continuing toward caudal as an interrupted series of single pores. Last dorsal spine hidden at base of first ray; spinous dorsal lower than soft; membrane between two not deeply notched; last spine $^1/_2$ length of next preceding; membrane from last dorsal ray reaching to, but not over, first small ray of caudal. Last anal ray completely free from caudal peduncle. *Female*: Head brown above, pale below. No dark markings on head except for traces of two broad, short bands from back of eye. Head covered everywhere by small white spots, except on throat; those on snout and upper lip rather widely spaced and sharply defined, those on side of head densely packed together; those on top of head larger and more widely spaced; few, or none, elongated and run together in vermiculations. Four broad silvery bands across edge of upper lip but not extending up unto snout. Throat rather evenly pale; an incomplete silvery Y antero-mesially; short white dashes at corner of mouth which are not extended as chevrons on to throat. Six broad, vertical dark bands, rather obscure, on sides of body, extending from dorsal fins to well below middle of side; single above, all but last deeply forked below. Abdomen pale but body every place else covered with white spots like those on head, but most of those on body horizontally elongated and somewhat run together giving the appearance of a number of narrow, horizontal lines running together in a network enclosing the light dots and spaces. In large specimens the dots become much smaller and more numerous until the horizontal arrangement is lost sight of completely and the broad vertical dark bands become even less distinct. Base of pectoral and anterior part of fin similarly white spotted, but with a broad, light vertical band with only a small amount of vermiculations on it. Spinous dorsal mottled with vermiculations and without distinct dark spots or pattern. Soft dorsal also mottled but with numerous fine, oblique, dark lines. Anal with white spots and mottlings more sharply defined and distinct than on dorsals. Caudal crossed by numerous fine, vermiculate, brown lines enclosing light spots. Pectoral crossed by 2 or 3 broad white bands which are more or less vermiculated with narrow, brown lines, especially basally. Ventrals uniformly pale. *Male*: Like above, but vermiculations not so evident and sharply outstanding.

Habitat: Sumatra!; Java!; Bali!. — Madagascar!, Seychelles!, India!, Burma, Andamans.

Note: Sauvage erred in describing the upper lip of *S. vermiculatus* as entire. A re-examination of the type (Paris Museum No. 1809a) shows the upper lip to be fully crenulate, as in Day's and Bleeker's specimens. A comparison of the specimens described bij Bleeker as *vermiculatus* (Leiden Museum No. 1812) and as *vermiculatoides* (Leiden Museum No. 4777) shows no difference whatever between them except that the vermiculations on the males of the latter collection are not so evident as in the females. These specimens are now somewhat discoloured. It is likely that there are slight differences in colour pattern between the sexes in life that are not now evident in the preserved specimens, but which Bleeker's sharp eye detected. He did not differentiate the sexes in Salariin blennies and frequently described the sexes of one species as separate species, No differences can be detected between Valenciennes's, Day's and Bleeker's specimens all of which have been examined.

6. **Salarias** Cuvier

Salarias Cuvier, Règne Anim., ii, 1817, p. 251.
Salarias of authors (not *Salaria* Forskål, Descr. Anim., 1775, pp. X, 22).
Erpicthys Swainson, Nat. Hist. Fishes, etc. ii, 1839, pp. 79, 182, 275, (*Erpichthys* in index).
Negoscartes Whitley, Mem. Queensland Mus. X (1), 1930, p. 20.
Crenalticus Whitley, loc. cit., p. 21.
Istiblennius Whitley, Austral. Zool. X, 1943, p. 185.

D. XIII-XVI. 15-23. A. II. 16-24. P. 14-16. V. I. 2-3.

Crest on head present or absent (often present in males, absent in females). Nasal cirrus simple, bifid or multifid, but always present. Supraorbital cirrus simple or multifid, but always present. Nuchal cirrus simple when present; absent in many species. Upper lip crenulate or entire. Lower lip smooth. Posterior canine on dentaries present or absent. No teeth on vomer. Teeth in both jaws very flexible, more than 150 in each jaw. Depth 4.4 to 6.4. Head 4.4 to 4.6. Lateral line a single series of pores curving down under the distal part of pectoral to middle of side and usually disappearing at this point, or even becoming indistinct before curving down. Spinous dorsal notched or not; equal to, or lower than, soft dorsal; free from caudal or partially attached to it. Spine of ventrals hidden, but always present and well developed; third ray often so closely bound to second as to be indistinguishable without dissection. Both anal spines of male readily apparent; first anal spine of female always buried in genital papilla, and second sometimes partially so. First anal rays of male anal sometimes very elongate; last anal ray either attached to caudal peduncle by membrane or free. Middle 9 rays of caudal always deeply branched, even in young.

Habitat: Tropical Indo-Western Pacific from Africa to Eastern Island and from southern Japan to northern Australia. About 30 species.

Note: It is quite possible that the assemblage of species here considered in *Salarias* are of heterogeneous origin. Species can be picked out which seem to lead to *Rhabdoblennius*, *Entomacrodus* or *Alticus*. Groups of several closely related species can be defined, but species may be found that appear to bridge the gaps between those groups. Other individual species appear quite distinctive and not closely related to these groups of species. To accept a less broad taxonomic category than that here considered would require the use of a considerable number of genera, not only those proposed by Whitley but several new ones. At the present stage of our knowledge of the relationships of these fishes such splitting would not appear to serve any useful purpose. The use of the crenulation of the lips as a definite character in the following key is a matter of convenience and not only does not reflect phylogenetic relationship. In some cases the splitting is obviously contrary to such relationships.

Key to the Indo-Australian species of Salarias

A. Upper lip crenulate.
  a. Nuchal cirrus present; supraorbital cirrus simple; or with a single filament on one or the other occassionally
    a^1. D. XII-17. A. II.-19. V. I-2. Nasal cirrus double. About half of the last anal ray attached membraneously to the caudal peduncle. First anal rays of male very elongate. A single row of 6 to 8 sharply defined black dots on body under latter part of spinous, and anterior $^3/_4$ of soft dorsal . . . . 1. *Salarias sinuosus* p. 298.
    b^1. D. XIII-20. A. II. 21. V. I-3. Nasal cirrus with 4 or 5 filaments. Last ray of anal completely free from caudal peduncle. First anal rays of male no longer than others. A double longitudinal row of white bars or spots, each surrounded by a black circle, present on side of body . . . . 2. *Salarias periophthalmus* p. 300.
  b. Nuchal cirrus absent; supraorbital cirrus simple or multifid; lower lip smooth or crenulate.
    a^1. Lower lip crenulate. No canines.
      a^2. Supraorbital cirrus simple, elongate and lanceolate. No black spot between dorsal spines. Crest of male rising to a peak posteriorly, with no free

posterior flap. Sexes widely different in coloration . . . . 3. *Salarias bellus* p. 304.

a^3. Uniformly dark, without dark spots on head or body, but generally with some small white dots on head and in two irregular horizontal rows on body . . 3a. *Salarias bellus,* male, p. 305.

b^3. Head and body generally lighter, without white spots, but the body thickly sprinkled with small dark spots which extend over vertical fins and unto head . . . . 3b. *Salarias bellus,* female, p. 305.

b^2. Supraorbital cirrus broad and flattened with filaments around its edge. A prominent black spot between first two dorsal spines. Crest absent or no higher than wide. Sexes similar in colour . . . 4. *Salarias unicolor amboinensis* p. 306.

b^1. Lower lip smooth; canines present or absent.

a^2. Crest on head lower than wide, or absent, in both sexes; strong canines in lower jaw; supraocular cirrus with no filaments on either side but with tip bifid or with 3 or 4 short filaments of equal length at tip; pectoral crossed by 3 or 4 rows of sharply defined small, black dots. 5. *Salarias chrysosipilus* p. 307.

b^2. Crest on head high and prominent in males; no canines in lower jaw; supraorbital cirrus pointed at tip with numerous filaments on both sides; pectoral without rows of black dots.

a^3. About six prominent, roughly parallel, black lines running along sides, more or less branching and running into one another, the upper 1 to 3 of these lines running into the black blotches at the base of the dorsal, the lines breaking up into prominent black dots and dashes on the caudal peduncle; head with numerous black dots, dashes, and wavy streaks on snout, under eye, and over whole side of head except lower opercle. 6. *Salarias lineatus* p. 309.

b^3. Dusky (not black) horizontal lines on sides regular, straight, rarely running into each other and not running into black blotches at base of dorsal, not breaking up into dots and dashes on caudal peduncle, the yellowish pale longitudinal lines on the side more prominent than the dusky lines between which they lie; head evenly dusky with only a single dark line curving down behind eye to corner of mouth. 7. *Salarias hasseltii* p. 313.

B. Both lips smooth.

a. Nuchal cirri multifid, bushy.

a^1. D. XII. 19 or 20. A. II-20 or 21. P. 14. Nasal cirrus stubby with a group of 6 or 7 short filaments at end and 1 or 2 on either side of pedicle; supraorbital cirrus with 2 or 3 branches of equal size from a common base, each of which may be multifid; no canines; prominent black bands enclosing light areas on pectoral base and isthmus, some of which are nearly as large as eye; abdomen much lighter than back and unspotted; prominent series of horizontal dashes and black lines on sides; 2 or 3 black spots on each pectoral ray, not arranged in cross rows on fin; caudal pale with small black dots scattered over middle of fin; throat crossed by 1 or 2 light bands; 2 to 7 or more sharply black spots on back under soft dorsal . . . . . 8. *Salarias fasciatus* p. 315.

*b*¹. D. XII-18, A. II-19. P. 15. Nasal cirrus flat and thin, with 4 or 5 long filaments at end and none on sides; supraorbital cirrus a single, thick, flattened, core with about 15 long, simple filaments around its edge; a small canine present on dentary; base of pectoral solid brown, with or without small black spots but without black lines or light areas; abdomen as dark as back and punctulated with small black spots; middle of sides plain brown, without longitudinal dashes or lines; 4 to 6 dark spots on pectoral ray, more or less arranged in transverse rows across fin; caudal dark, mottled with lighter punctulations over all of fin; throat uniformly brown; no prominent black dots on back under soft dorsal . . . . 9. *Salarias ceramensis* p. 318.

b. Nuchal cirri simple or absent, or if not entirely simple then with only a few tiny filaments less than the length of cirrus on its sides.

*a*¹. Nasal cirrus simple; ventral I-2, or the third ray completely bound to the second and only visible by dissection.

*a*². D. XII. 17 or 18. A. II-19. A posterior canine on dentary. Membrane from last dorsal ray reaching to, but not overlying, first small rays of caudal. Last anal ray half bound to caudal peduncle. Nuchal cirrus present. Ventrals I-2.

a^3. A crest present in both sexes $^1/_2$ pupil high in female, as high as eye in large male, but always higher than wide; supraorbital and nuchal cirri slender, simple, and pointed at tip; numerous white dots on head and body, especially anteriorly . 10. *Salarias sexfilum* p. 319.

b^3. No crest on head in either sex, or at most a lower fleshy ridge wider than high in large specimens; supraorbital cirrus bifid or trifid at tip; nuchal cirrus spatulate, wider distally than proximally, ragged or with definite tiny filaments around edge; ordinarily no white spots anteriorly; a pair of big black or blue spots on throat . . . .. . 11. *Salarias guttatus* p. 320.

b^2. D. XIII. 21. A. II. 23. No canines. Membrane from last dorsal ray covering all of small caudal rays. Last anal ray completely free from caudal peduncle. No nuchal cirri. Ventrals I-3, but the third ray visible only by dissection. . . . . . 12. *Salarias mulleri* p. 322.

b^1. Nasal cirrus multifid; ventrals I-3, the third ray small but plainly visible without dissection.

a^1. Supraorbital cirrus with numerous filaments on either side.

a^2. D. XIV (rarely XIII or XV). 17 to 19 (rarely 20). Membrane from last ray reaching to, but not over, first small caudal rays. A. II-19 to 21. No rows of spots on lower part of caudal peduncle. Both sexes coloured alike . . . . . . 13. *Salarias goesii* p. 324.

b^2. D. XIII (rarely XIV), — 21 to 23, membrane from last dorsal ray covering all of first small caudal rays. A. II-23 to 25. Ten to twenty round dark dots on the caudal peduncle, usually arranged in a double horizontal line. Male without spots on dorsal, caudal and pectorals; female with dorsal, caudal and pectorals heavily spotted . . . . 14. *Salarias dussumieri* p. 325.

b^1. Supraorbital cirrus simple.

a^2. Dorsal broadly connected to caudal, the membrane from last ray reaching up over all small caudal rays; no canines; nuchal cirrus present . . . . 15. *Salarias edentulus* p. 328.

b^2. Membrane from last dorsal ray either free of caudal rays or only reaching over first or second small ray; a posterior canine on dentary; nuchal cirrus present or absent.

a^3. Three to 8 narrow black lines running longitudinally along sides.

a^4. Crest low, never more than 1/2 diameter of eye in height. Caudal, dorsal and anal with rows of sharply defined black spots. No black-rimmed silvery spots on sides. Vertical body bands poorly defined. First anal spine hidden in fleshy genital papilla . . . . . . 16. *Salarias cyanostigma,* female, p. 334.

b^4. A prominent fleshy crest on head as high as eye, or nearly so, or higher. Dorsal and anal without rows of white spots. A double row of prominent oblong, black-rimmed spots horizontally along middle of sides, the spots borne upon the vertical body bands. Both anal spines visible.

a^5. Only 3 fine, longitudinal black lines on body and they confined to 3d and 4th vertical body bands and light spaces between them (often missing; see below). Usually a small black dot below big black spot on opercle, but never one above it. Pectorals unspotted. Caudal with 5 or 6 dark cross bands. Often numerous auxiliary black-rimmed white spots posteriorly on sides besides two regular rows . 16. *Salarias cyanostigma,* male, p. 332.

b^5. About 8 fine, longitudinal black lines extending along most of length of sides. A black dot above large black spot on opercle, and often one below as well. Pectoral with 6 or more small black spots on outer half of middle rays. Caudal without dark cross bands. No auxiliary white spots on sides posteriorly besides the two regular rows . . . 17. *Salarias bilitonensis,* male, p. 335.

b^3. No black lines running horizontally on sides (except rows of black dashes on S. *interruptus,* female).

a^4. A high, fleshy crest on head nearly as high as eye. Numerous black-rimmed white spots on sides posteriorly besides two regular rows, or three short horizontal black lines on body between 3d and 4th vertical bands, or both . . . . 16. *Salarias cyanostigma,* male, p. 332.

b^4. Either no crest on head, or only a low, fleshy ridge as wide as high.

a^5. A double row of prominent, oblong, black-rimmed spots horizontally along middle of sides, the spots borne upon vertical body bands.

a^6. Nuchal cirri present. Silvery spot in upper row over middle of anal surrounded by a black circle much larger than that around other spots on side, or often the silvery spot obscured and only a black blotch left, larger than pupil. Spinous dorsal with 2 or 3 longitudinal rows of dark dots on membranes between spines . . . . 18. *Salarias bleekeri* p. 338.

b^6. No nuchal cirri. None of black circles around light spots on sides especially enlarged. Spinous dorsal without dark spots on membranes . 19. *Salarias interruptus,* male, p. 340

b^5. No black-rimmed, silvery spots in double row on body. Caudal, and usually soft dorsal, crossed with rows of prominent black spots.

a^6. Sharply defined black dashes arranged in 4 or 5 interrupted longitudinal lines on body. Pectoral without dark spots. Anal with a small, sharply-defined black spot behind each ray. First anal spine hidden in fleshy genital papilla . . . . 19. *Salarias interruptus,* female, p. 341.

b^6. No black dashes arranged in horizontal lines on body. Pectoral with or without black spots on rays. Anal either unspotted, or with a dark spot behind every other ray. First anal spine as noted below.

*a*⁷. No black spot as large as pupil on membrane between first two dorsal spines. Two narrow, vertical, black dashes in a line behind eye. No large, oval light spots on head and upper part of body. Six or more black spots on pectoral. First anal spine hidden in fleshy genital papilla . . . 17. *Salarias bilitonensis,* female, p. 337.

*b*⁷. A sharply defined black spot as large as pupil on membrane between first two dorsal spines. No narrow, vertical, black dashes behind eye. Numerous oval, light spots on head and upper part of body. No black spots on pectoral . . . 20. *Salarias gibbifrons* p. 342.

1. **Salarias sinuosus** Snyder (Fig. 48, p. 299)

Salarias sinuosus Snyder, Proc. U. S. Nat. Mus. XXXV, 1908, p. 109.
Salarias crenulatus M. Weber, Notes Leyden Mus. XXXI, 1909, p. 144.
Salarias sinuosus Snyder, Proc. U. S. Nat. Mus. XXXXII, 1912, p. 519.
Salarias crenulatus M. Weber, Siboga Exp. Fische, 1913, p. 532.

Salarias crenulatus McCulloch, Rec. Austral. Mus. XIV (2), 1923, p. 124.

Salarias crenulatus pallidus Whitley, Austral. Zool. IV (4), 1926, p. 235. Rec. Austral. Mus. XVI (6), 1928, p. 303.

Salarias pallidus McCulloch, Check list Fish. Austral. pt. III, 1929, p. 345.

Crenalticus crenulatus pallidus Whitley, Mem. Queensl. Mus. V (1), 1930, p. 21.

Salarias crenulatus Fowler, Mem. B. P. Bishop Mus., XI, (6), 1934, p. 446.

D. XII. 16-17. A. II. 17-19. P. 14. V. I-2.

No crest in either sex, but in both sexes a low ridge no higher than wide in its place. Nasal cirrus slender, pointed and double, the dorsal one equal in length to diameter of pupil, the other a little shorter. Supraorbital cirrus $^{1}/_{2}$ to $^{2}/_{3}$ diamter of eye in height, slender and pointed; simple, or occasionally with a single incidental filament near base. Nuchal cirrus broad at base, pointed, simple and half the pupil in length. Anterior profile approximately vertical. Upper lip strongly crenulate throughout length. Lower lip smooth. A tiny canine posteriorly on each dentary. Depth 5.5-5.8. Head 4.6-5.0. Middle dorsal spines a little shorter than the rays; last 2 or 3 taper off, leaving shallow notch between dorsals, but last spine only a little shorter than next. Membrane from last dorsal ray extending over first few small caudal rays. Last anal ray with basal half bound membraneously to caudal peduncle. Second and third rays of male greatly elongated, equaling depth of body in length; next few rays moderately elongated; last half of fin of normal height ($^{2}/_{3}$ height of soft dorsal); membrane deeply excised between elongated rays. Anal rays of female not modified or lengthened. Caudal truncate and shorter than head by length of snout. Longest pectoral ray shorter than head by snout and half the eye. Longest ventral ray a little shorter than postorbital length of head. *Male*: Lower part of cheek, upper part of opercle, snout and upper lip more or less dark, with edge of preopercle especially dark. Lower

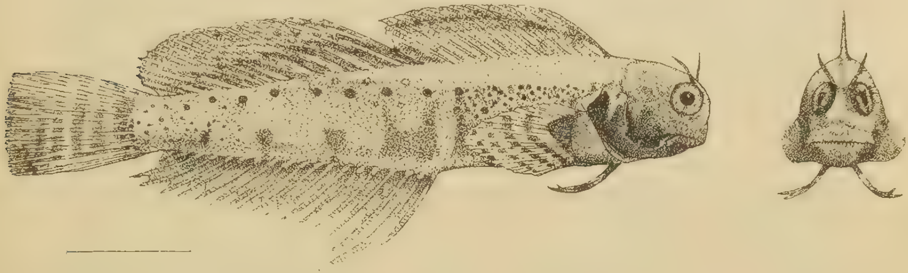

Fig. 48. *Salarias sinuosus* Snyder.

lip crossed by 5 white bars. Throat generally dusky. Vertical dark bands of body only faintly and irregularly distinguishable even dorsally, where they extend slightly unto dorsal fin; more or les double dorsally, but single laterally. Body generally covered with small black specks which extend unto top of head, and are gathered into vermiculations ventrally behind the abdomen. A row of 6 to 8 sharply-defined, prominent, black dots more than half the size of pupil, extending horizontally on upper part of side under latter part of spinous, and anterior $^3/_4$ of soft dorsal. Narrow dark streamers going up obliquely unto dorsal from vertical body bands; basal half of fin heavily pigmented, shading into clear outer half. Two or 3 sharply-defined, small, dark dots on each ray and spine, of dorsal. Anal duskiest submarginally, but edge of fin not distinctly lighter than this band. Lower half of caudal pigmented; middle half bearing dark dots like dorsal, but not arranged into rows; upper third of fin light, the membranes clear. Base of pectoral rays dark; three well defined bands of spots vertically across fin. Base of pelvic dark, a dark band acrosss middle of rays, and a second near tip of second ray. *Female*: Dots on dorsal rays and spines diffuse. Anal darker submarginally; edge of fin white. Colour otherwise substantially as in male.

Habitat: Sulu Islands!; Tiur! — Ryu Kyu Islands! Bismar Islands! Northwest Inlet, Queensland; New Hebrides.

Note: An examination of the types of *crenulatus* in the Amsterdam Museum show them to be conspecific with Snyder's material. The above description is drawn from the cotypes of *S. sinuosus*, Stanford Museum No. 21111. The only significant difference between these specimens and *S. pallidus* is the presence of one or two more dorsal rays in the latter. This species is most closely related to the group of species around *S. guttatus*, and not particularly closely to the following species.

2. **Salarias periophthalmus** C. and V.

Salarias periophthalmus Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 311.

Salarias biseriatus Cuvier and Valenciennes, Hist. Nat. Poiss., XI, 1836, p. 316.

Salarias periophthalmus Bleeker, Nat. Tijds. Ned. Ind. IV, 1853, p. 267; VII, 1854, p. 62; X, 1855, p. 361; XII, 1856-57, pp. 199, 220, 233; XIII, 1857, pp. 372, 479; XV, 1858, p. 403; Act. Soc. Sc. Indo-Neerl. VIII, 1860, pp. 43, 45; Ned. Tijdschr. Dierk. I, 1863, p. 236; II, 1865, p. 293; Poissons Madagascar, 1875, p. 74.

Salarias cyanostigma (not of Bleeker) Klunzinger, Verh. K. K. zool-botan. Gesel. Wien XXI, 1871, p. 491.

Salarias paulus Bryan and Herre, Occ. Pap. B. P. Bishop. Mus. II (1), 1903, p. 136,

Salarias paulus Jordan and Seale, Bull. U. S. Bur. Fish. XXV, 1906, p. 431.

Salarias muscarus Snyder, Proc. U. S. Nat. Mus. XXXV, 1908, p. 109; XXXXII, 1912, p. 519.

Alticus periophthalmus Jordan and Seale, Bull. U. S. Bur. Fish. XXV, 1906, p. 422.

Alticus periophthalmus Kendall and Goldsborough, Mem. Mus. Comp. Zool. XXVI (7), 1911, p. 325.

Alticus periophthalmus Kendall and Radcliffe, Mem. Mus. Comp. Zool., XXXV, 1912, p. 155.

Salarias periophthalmus M. Weber, Siboga Exp. Fische, 1913, p. 532 (in part).

Salarias periophthalmus Herre, Fishes of Herre Phil. Exp., 1934, p. 97 (in part); Phil. Jour. Sci. LXX (4), 1939, p. 352 (in part); Rec. Ind. Mus. Calcutta, XXXXI (4), 1939, p. 363 (in part).

Salarias periophthalmus Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 284 (in part).

D. XIII. 20. A. II. 21. P. 14. V. I-3.

Large males with a low fleshy ridge not 1/3 pupil diameter in height; smaller males and females with no trace of crest. Nasal cirrus with 4 or 5 slender filaments borne palmately on pedicle shorter than filaments; inner filament the longest; entire organ a little shorter than diameter of pupil. Supraorbital cirrus 2/3 eye in height, simple, very slender, and pointed. Nuchal cirrus slender, simple, pointed, a little shorter than pupil. Forehead protruding. Upper lip crenulate along its whole length; lower lip smooth. A single, tiny posterior canine barely emerging from membranes on each dentary. Depth 4.2 to 4.7. Head 5.7 to 6.0. Dorsal notched to about half height between spinous and soft portions; last spine 2/3 height of preceding one, although somewhat buried in membranes of notch. Spinous dorsal about same height as soft dorsal. Membrane from last dorsal rays covering first two small rays of caudal. First few rays not especially elongate or otherwise modified; last anal ray free from caudal peduncle. Longest pectoral ray shorter than head by snout and half the eye. *Male*: General coloration light olive gray. A black triangular spot at upper corner of opercle, about as large as pupil. A broad, diffuse, dusky band from lower margin of eye over upper lip and a similar band over middle of upper lip. Opercle and lower half of cheek sprinkled with tiny black dots. Posterior edge of gill membrane narrowly dark, with remainder of throat light and peppered with tiny dark dots, or with entire throat evenly dusky. Vertical body bands forked below. At V of ventral fork, and directly above it on upper part of band, a round white spot surrounded by a black circle; these pairs of spots present on five posterior body bands and forming 2 longitudinal, parallel rows of prominent spots along middle of side. Above this an irregular double row of tiny black dots like those on cheeks, and a few of the same sprinkled on caudal peduncle. Abdomen pale and unmarked. Proximal $^2/_3$ of spinous dorsal dark, mottled, but not definitely stippled or spotted. Beyond this is a row of large brown dots, one on each spine, and an incomplete row of similar, smaller dots. Edge of fin clear. Basal $^2/_3$ of soft dorsal mottled like spinous dorsal. Distal to this are 2 or 3 wavy, narrow dark and light lines parallel to edge of fin, which is clear. Basal $^2/_3$ of anal clear, shading into a very dark submarginal band, with tips of rays lighter; no spots or lines on anal. A pair of small black dots, one above the other, at base of middle caudal rays with a narrow, dusky line extending out unto fin from each; dorsal and ventral edges of fin dusky, but fin otherwise clear and without spots or vertical bands. Base of pectoral light, with a few faded dark dots; fin clear and light except for a rather indistinct, incomplete, single row of dots across basal third of rays. Base of ventrals dusky; fin pale and without markings. *Female*: A broad, pale line behind eye passing over top of head to meet that of other side; on posterior edge of pale line, opposite eye, two short, black, narrow dashes. A narrow white dash with black borders under eye. Indistinct light dots over rest of head. A broad, dark crescent across throat from corner to corner of mouth, occupying mesial $^3/_4$ of throat and separated from dark edge of gill membrane mesially by a narrow, light band. Alternate dark and light bands across lips more sharply defined than in male. Vertical body bands more sharply defined than in male. Double line of dark bordered white spots on sides inclined to fade and leave only dusky spots. Numerous characteristic small black dots that stand out sharply against ground coloration scattered indiscriminately over pectoral base and entire body except the lower part of the abdomen. Each vertical body band bifurcate dorsally, sending a splash of brown over base of adjacent rays or fins of dorsal. Membranes of both dorsals mostly clear; 2 or 3 irregular brown blotches on each spine, the smaller distal ones joined together by a faint submarginal dusky band parallel to edge of fin. Outer third of soft dorsal with membrane evenly dusky; basal $^2/_3$ with diffuse brown spots on rays overlapping on to membrane. Anal fin much lighter than in male; submarginal dusky band diffuse, and tips of rays white.

Habitat: Sumatra; Ternate; Batu; Sangir; Prigi, Java; Tiur! East Indies! — Philippine Islands!; Ryu Kyu Islands!; Durban, Natal!; Andaman Islands!; Nissan Islands!; Santa Cruz Islands!; Guam!; Samoa!; Tahiti! Phoenix Islands; Swain's Island!; Marquesas Islands!; Hull Island!; Enderbury Island!

Note: This species belongs in the relationship *interruptus, cyanostigma, bilitonensis, gibbifrons,* etc., treated below. From all of these it is easily distinguished by the combination of a crenulate upper lip and nuchal cirri being present. The synonymy of the species is quite confused because of this species being mixed up with the others of this relationship. In nearly all collections examined at least two species were mixed under the same label, and sometimes 6 or 7. The synonymy listed above is accurate but not comprehensive for Polynesia.

To add to the confusion two forms of the species can be distinguished. Among specimens examined from Japan, Philippines, East Indies, Andamans, and Natal no differences could be discovered. They are as noted above, the description being drawn from Philippine specimens. Specimens from Polynesia, Micronesia and Melanesia differ from these, however, in the following details: The small, black dots of the body and pectoral base which are so typical of Indian Ocean and western Pacific females, and found somewhat developed in the males, are completely absent from the Oceanic form. The pale dashes behind the eye are not united over the top of the head. The posterior opercular spot is not strongly developed and the alternating dark and light bands over the upper lip are poorly developed or absent. The vertical body bands range from very strong delineation to nearly complete absence. There is a tendency toward melanism in the males and there is a considerable range of basic coloration from dark brown to pale green.

The type, a male 85 mm., from the Santa Cruz Archipelago (Paris Museum No. 857) is typical of the latter form. An examination of the type of *S. biseriatus* (Paris Museum 2150a) shows that it is a small (34 mm.) specimen of *periophthalmus* and not the species which others, following Kner, have called *biseriatus*. Its locality is listed as Indian Archipelago, without more specific data. While its coloration is too faded to distinguish, other specimens taken by Weber in the East Indies show that form to have the colour pattern of the western Pacific Indian Ocean form, thus making *biseriatus* available as a sub-specific designation for that form. Valenciennes did not distinguish the crenulate upper lip and muchal cirri which both of the above type specimens have. This contributed to the confusion among the species of *Salarias* which have the double row of blackcircled white spots on the body.

The presence of spots on the pectoral, numerous black dots on the body posteriorly and the nuchal cirri mentioned by Klunzinger show that his Red Sea specimens are this species and not *cyanostigma* of Bleeker, which does not have these characters. The types of *S. muscarus* Snyder are well coloured specimens of the western Pacific form of the species; *S. paulus* is the Oceanic, typical form of the species.

3. **Salarias bellus** (Günther)

Salarias bellus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 257.
Salarias bellus Bleeker, Ned. Tijdschr. Dierk., IV, 1873, p. 129 (compiled).
Salarias bellus Chu, Index piscium sinensium, 1931, p. 171 (compiled).
Salarias Kellersi Fowler, Proc. U. S. Nat. Mus. LXXXI (8), 1932, p. 6.
Salarias Kellersi Fowler, Mem. B. P. Bishop Mus. XI (6), 1934, p. 445.
Salarias leopardus (not of Day, nor of Fowler, 1904) Fowler, Mon. Acad. Nat. Sci. Philadelphia II, 1938, p. 82.

D. XIII. 20-21. A. II. 20-22. P. 14. V. I. 3.

Male with a well developed crest $1^2/_3$ eye in length, $^2/_3$ to 1 times eye in height, sloping up regularly from its origin to its greatest height over the posterior end of the base; posterior edge nearly vertical, with no free flap projecting. No crest in females except in largest specimens, where a faint ridge is apparent posteriorly. Nasal cirrus about $^2/_3$ pupil in length, slender and pointed; 1 or 2 scarcely noticeable tiny filaments off the main cirrus, usually on the outer side. Supraorbital cirrus simple, slender, pointed and from $^1/_2$ to $^2/_3$ eye in length. No nuchal cirri. Forehead curving back evenly from rather prominent snout. Both upper and lower lips very finely, somewhat irregularly, but consistently crenulate along whole length. Upper lip actually double in its mesial half where the outer crenulate lip is separated by a deep groove from the inner smooth lip. No canine teeth on dentaries. Depth 4.1 to 4.8. Head 4.9 to 5.9. Dorsal fin deeply notched; the last spine, which is somewhat buried at the bottom of the notch, less than $^1/_4$ the height of first ray. Last ray of dorsal bound to caudal peduncle by a membrane which extends over the second ray caudal rays nearly as far as in *S. edentulus*. First few anal rays not especially elongate or modified; last ray free from caudal peduncle. Longest pectoral ray shorter than head by length of snout. *Male*: Soberly coloured a rich brown. No black spot behind eye. A row of 3 to 5 white spots under eye. An oblique line of about 5 white spots across cheek from nape to corner of mouth. Other white spots on snout, upper lip, cheek, opercle, and between eyes. Crest a little darker than head. Lower lip dark; remainder of throat evenly lighter. Vertical body bands incompletely double and not standing out plainly; most obvious dorsally where they extend briefly onto dorsal. Two irregular, longitudinal rows of white spots along side, with other spots occasionally outside these series. Vertical fins dark. Spinous dorsal and paired fins unmarked. About 15 narrow, white, oblique lines on soft dorsal often breaking up into dots and dashes distally. Longitudinal narrow white lines on membrane between principle caudal rays, often breaking up into dots and dashes. Vertical white lines between anal rays, which may break up into 2 to 5 white dots. Base of pectoral crossed vertically by a characteristic narrow band which is light in the center and has dark borders. While these white markings stand out sharply on some males they may be more or less absent and an occasional male may be completely dark except for a few white spots under eye. *Female*: Entirely different colour pattern than male and, in contrast, very prominently marked. Base colour a light, creamy tan. Throat and abdomen solidly pale with no markings. Head and body every where else covered closely with reddish brown spots about the size of pupil or smaller. Vertical body bands only faintly and incompletely visible under this spotting. On the sides the spots often run together somewhat to form short vermiculations. Directly over base of anal the spots are thinned out and more widely spaced. Dusky band behind eye still traceable and lower lip narrowly dark. All of fins except ventrals covered by same type of spots, although a little smaller than those on body; not arranged in regular patterns or rows. Anal has, besides, a dusky submarginal line with tips of rays light. Spots on pectoral confined largely to basal $^2/_3$ of fin, leaving margin clear, but on the caudal the spots cover the entire fin. On the vertical fins there are more spots on the membranes than on the spines and rays.

Habitat: Zanzibar! Mombassa! Seychelles! China Seas! Tonga Islands!; Marquesas Islands!

Note: The above species has generally been reported as *edentulus, oortii,* or *dussumieri*. The female has been described twice by Fowler as *kellersi* and *leopardus*. Examination of the types of those species reveals no significant differences between them, or between them and females from the Indian Ocean. While the type series of *S. bellus* (British Museum 1848.3.16) contained specimens of three species of *Salarias*, the description was obviously drawn from the largest specimen (121 mm. st. length, $5^4/_5$ inches long with tail), which is a male of this species. The species is apparently most closely related to the *unicolor-amboinensis-meleagris* forms, from which it differs as noted in the above key.

4. **Salarias unicolor amboinensis** Bleeker

Salarias amboinensis Bleeker, Act. Soc. Sc. Indo-Neerl., II, 1857, p. 67.
Salarias amboinensis Günther, Cat. Fish. Brit. Mus. III, 1861, p. 244 (compiled).
Salarias amboinensis M. Weber, Siboga Exped. Fische, 1913, p. 529.
Salarias amboinensis de Beaufort, Bijdr. Dierk. Afl. XIX, 1913, p. 148.
Salarias amboinensis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 438 (compiled).

D. XIII. 18-20. A. II. 20-21. P. 14. V. I. 3.

Crest on male low, wider than high, very fleshy but definite as a raised lump widest and highest behind; no trace of crest on females. Nasal cirrus flattened, simple (or with a few tiny filaments), lanceolate, a little shorter than pupil. Orbital cirrus flat, nearly circular, nearly as large (female) or a little larger (male) than eye, with short, flat, simple filaments all around its edge. No nuchal cirri. Forehead evenly rounded. Upper lip crenulate evenly all along its length. Lower lip weakly crenulate in middle half but smooth, or with only traces of fine crenulations, laterally. Depth 4.9-5.7. Head 4.4 to 4.7. Lateral line curving down behind pectoral and faintly distinguishable back to caudal peduncle. Spinous dorsal a little lower than soft; only a very slight notch between the two, with last spine just as high as the next preceding one; membrane from last ray reaching to, but not over, first small ray of caudal. Anal spines and rays unmodified; last ray free from caudal peduncle. *Male*: No definite black spot behind eye. Three bands going down over upper lip from eye. Head dark, mottled but not clearly. Throat evenly pale to dusky. Body overall dark, except for abdomen which is pale. Vertical body bands obscure but visible partially below and above, where they are apparent as paired spots at base of dorsal; finely dusted with obscure black dots. Body irregularly mottled all over, except on abdomen, with white lines and small blotches. A sharply distinguished black spot on upper half of membrane between first two dorsal spines. Both dorsals mottled by many small dark spots more or less joined by lines distally; basal part dark but mottled with larger white markings. Caudal dusky, with the cross bands mostly obscured by melanism. Anal pale proximally, with a dark submarginal band, and the tips of the rays white. Bands on pectoral faint and only partially evident. Ventrals pale. *Female*: Like male, but white spots, and vermiculations on body mostly behind anus; caudal with paired spots at base and crossed by 3 to 5 irregular, broad, dark bands; pectoral with 4 rather broad, dark cross bands, the base mottled; soft dorsal with 2 to 4 spots on outer half of each ray.

Habitat: Ambon!; Waigeu!; Sangi Islands; Talaut Islands.

Note: This is certainly the Indo-Australian archipelago cognate of *S. unicolor* Rüppel of the Indian Ocean. *Unicolor* has the nasal cirrus with 6 or 7 definite filaments, the supraorbital cirrus slender and pointed, a definite crest on the male, a prominent black blotch behind the eye, numerous white dots on head, white dots on body of male in 2 longitudinal lines, white spots scattered profusely over anterior part of female body, and no black blotch between the first two dorsal spines. Otherwise the forms are quite similar. The species is also closely related to the Australian *S. meleagris*, which has, however, nuchal cirri, supraorbital cirri with the filaments subdivided and bushy, and the middle half of the lower lip smooth, with the corners weakly crenulate.

5. **Salarias chrysospilos** Bleeker

Salarias chrysospilos Bleeker, Act. Soc. Sc. Indo-Neerl. II, 1857, p. 66.
Salarias chrysospilos Günther, Cat. Brit. Mus III, 1861, p. 250 (compiled).
Salarias coronatus Günther, Ann. Mag. Nat. Hist. (4) X, 1872, p. 424, — in Brenchley's „Cruise of the Cura", 1873, pp. 410, 424. — Jour. Mus. Godeffroy XIII, 1877, p. 206.
Salarias nitidus (not of Günther, 1861) Günther, Jour. Mus. Godeffroy XIII, 1877, p. 200 (Samoa and Bonham Island specimens only).
Salarias belemnites De Vis, Proc. Linn. Soc. N. S. Wales, IX, 1884, p. 695.
Salarias nitidus Seale, Occ. Papers. B. P. Bishop Mus. 1 (3), 1091, p. 127.
Salarias nitidus (not of Günther, 1861) Steindachner, Sitz. Ak. Wiss. Wien. CXV (1), 1906, p. 1410.
Salarias coronatus Seale, Occ. Pap. B. P. Bishop Mus. IV (1), 1906, p. 86.
Alticus evermanni Jordan and Seale, Bull. U. S. Bur. Fish. XXV, 1906, p. 422.
Alticus coronatus Jordan and Seale, Bull. U. S. Bur. Fish. XXV, 1906, p. 424.
Salarias belemnites McCulloch, Rec. Austr. Mus. XV (1), 1926, p. 38.
Salarias coronatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 437.
Salarias nitidus (not of Günther, 1861) Fowler, Mem. B. P. Bishop. Mus. X, 1928, p. 434 (compiled).
Salarias coronatus Fowler, Mem. B. P. Bishop Mus. XI (6), 1934, p. 446.

Salarias belemnites Herre, Phil. Jour. Sci. LXX (4), 1939, p. 351.
Salarias nitidus (not of Günther, 1861) Schultz, Bull. U. S. Nat. Mus. CLXXX, 1943, p. 285.

D. XIII. 18-21. A. II. 19-22. P. 14. V. I. 3.

Trace of a crest no higher than wide in largest males; absent in others and in females. Nasal cirrus shorter than pupil, of 6 to 8 slender cirri borne palmately on short pedicle. Supraorbital cirrus about $^2/_3$ eye in height, slender, but as broad at tip as at base; no filaments on sides but either bifurcate at tip or ending in 3 or 4 short filaments of equal size. No nuchal cirri (or irregularly occurrent in Micronesian form). Forehead slightly projecting. Pupil oval and slanting downward. Upper lip finely crenulate throughout entire length. Lower lip smooth. A prominent, recurved canine nearly as long as pupil posteriorly on each dentary. Depth 5.5 to 7.3. Head 4.4 to 5.3. Dorsal notched to about half its depth; last spine more than half length of next preceding, but somewhat buried in membranes at base of notch; two parts of dorsal about equal in height; membrane from last ray reaching to, but not unto, secondary caudal rays. Anal as high as body and a little higher than soft dorsal; anterior rays not especially elongate or otherwise modified; last ray free from caudal peduncle. Longest pectoral ray equal to postorbital length of head. *Male*: A crown of small white spots on top of head; a similar, larger spot behind eye bordered posteriorly by a narrow, crescentic black line; other white spots on snout, upper lip, upper cheek, upper opercle and more faintly on the lower cheek. Throat, abdomen, and lower part of body unmarked. Body otherwise reddish brown with many white spots on back and white vermiculations on the side which are much anastomosed, anteriorly into U shaped groups, but forming irregular longitudinal lines on body behind anus. Spinous dorsal clear yellowish with tip of spines sharply black. Scattered dark spots on soft dorsal. Anal pale with a submarginal dark band. Caudal, pectorals and ventrals reddish brown. *Female*: Like male except that there are pairs of vertical white bars on upper half of body behind anal, repeated as spots at base of anal but interrupted on middle of body. Under spinous dorsal the bands tend to break up into spots. No longitudinal white vermiculations on side as in males. Spots on top of head as bright as in males, and tips of dorsal spines black.

Habitat: Ambon! — Solomon Islands! Samoa! Marshall Islands! Leeward Society Islands!; Marquesas; Queensland; New Hebrides.

Note: This species has not been taken in the East Indies since Bleeker's time. His specimens (Leiden Museum 4788) are still in good condition and brightly coloured, more so than most specimens collected within the past two years in the Marshall Islands. Like other forms of *Salarias* this species becomes somewhat different from the East Indian form in Micronesia, Melanesia, and Polynesia.

In particular the male of the latter always has a prominent black spot a little larger than the pupil on the middle of the side below the second dorsal spine; this is absent on the female, and on both sexes in the East Indian form. There are dark crescents on the throat, and 4 or 5 rows of sharply defined black spots across the pectoral. The male has short, small horizontal dashes over the entire body, not spots and vermiculations as in the East Indian form. In the Marshall Islands form a simple nuchal cirrus is found on either or both sides of the nape in about $^1/_3$ of the specimens. There are no other anatomical differences and the major part of the colour pattern is the same.

The terminology of the species has been confused since Günther (1877) described and figured the male as *S. nitidus*. His true *S. nitidus* (Günther, 1861) from the China coast is a species of *Rhabloblennius* with a colour pattern much like the above. Günther had previously described the female as *S. coronatus*. Jordan and Seale perceived Günther's error on the male and introduced the new name *A. evermanni* for the Polynesian form. McCulloch (1926) noted that the name *S. belemnites* De Vis had priority for this species. In this mix-up Bleeker's well described species was overlooked, as so many of his species have been. Bleeker described the supraorbital cirrus as simple. His specimens are as described above, and he had corrected this statement in his unpublished MS. for the Atlas, saying of the orbital cirri: "apices bifida".

6. **Salarias lineatus** C. and V.

Salarias lineatus Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 314.
Salarias kingii Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 334.
Salarias lineatus Bleeker, Verh. Bat. Gen. XXII, 1849, pp. 3, 5, 7, 18.
Salarias lineatus Bleeker, Verh. Bat. Gen. XXIII, 1850, p. 9.
Salarias lineatus Bleeker, Nat. Tijdschr. Ned. Ind. I, 1850, p. 238, 241.
Salarias kingii Bleeker, Verh. Akad. Amsterdam II, 1855, p. 11 (compiled).
Salarias lineatus Bleeker, Nat. Tijdschr. Ned. Ind. XV, 1858, p. 403.
Salarias lineatus Bleeker, Nat. Tijdschr. Ned. Ind. XIX, 1859, pp. 331, 333.
Salarias lineatus Bleeker, Nat. Tijdschr. Ned. Ind. XX, 1859, p. 203.
Salarias lineatus Bleeker, Act. Soc. Ind. Neerl. (2) VI, 1859, p. 5.

Salarias lineatus Bleeker, Nat. Tijdschr. Ned. Ind. XXII, 1861, pp. 100, 245.
Salarias kingii Günther, Cat. Fish. Brit. Mus. III, 1861, p. 240 (listed as doubtful species).
Salarias lineatus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 254 (compiled).
Salarias lineatus Bleeker, Versl. Akad. Amst. (2) II, 1868, pp. 284, 288.
Salarias lineatus Bleeker, Arch. Neer. Sc. Nat. XIII, 1878, p. 54.
Salarias lineatus Day, Proc. Zool. Soc. London, 1870, p. 695.
Salarias lineatus Day, Proc. Zool. Soc. London, 1873, p. 111.
Salarias lineatus Day, Fishes of India, 1876, p. 332; Supplement, 1888, p. 798.
Salarias lineatus Steindachner, Sitzb. Ak. Wiss. Wien, 1868, p. 996.
Salarias lineatus Steindachner, Sitzb. Ak. Wiss. Wien, CXV (1), 1906, p. 1411.
Salarias lineatus Seale, Occ. Pap. B. P. Bishop Mus. IV (1), 1906, p. 86.
Salarias lineatus Jordan and Seale, Bull. U. S. Bur. Fish., XXV, 1906, p. 426.
Salarias lineatus Jordan and Dickerson, Proc. U. S. Nat. Mus. XXXIV, 1908, p. 617.
Salarias lineatus Kendall and Goldsborough, Mem. Mus. Comp. Zool. XXVI (7), 1911, p. 326.
Salarias lineatus Kendall and Radcliffe, Mem. Mus. Comp. Zool. XXXV, 1912, p. 158.
Salarias lineatus Snyder, Proc. U. S. Nat. Mus. XXXXII, 1912, p. 448.
Salarias lineatus M. Weber, Siboga Exp. Fische, 1913, p. 534.
Salarias lineatus Zugmayer, Abhl. Bayer. Akad. Wiss. München XXVI (6), 1913, p. 15.
Salarias lineatus Jordan, Tanaka and Snyder, Journ. Coll. Sci. Tokyo XXXII (1), 1913, p. 384 (compiled).
Salarias lineatus de Beaufort, Bijdr. Dierk. Amsterdam XIX, 1913, p. 149.
Salarias lineatus McCulloch and McNeil, Rec. Austr. Mus. XII (2), 1918, p. 18.
Salarias lineatus Fowler and Bean, Proc. U. S. Nat. Mus. LXXI, 1927, p. 15.
Salarias lineatus Fowler, Bull. B. P. Bishop Mus. XXXVIII, 1927, p. 30.
Salarias lineatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 442.
Salarias lineatus Fowler, Mem. B. P. Bishop Mus. XI, (5), 1931, p. 364.
Salarias lineatus Fowler, Proc. U. S. Nat. Mus. LXXXI (8), 1932, p. 9.
Salarias lineatus Fowler, Mem. B. P. Bishop Mus. XI (6), 1934, p. 446.
Salarias lineatus Whitley, Jour. Pan-Pacific Res. Inst. III (1), 1928, p. 13.
Salarias kingii McCulloch, Check list Fish. Austral. III, 1929, p. 344.
Salarias lineatus McCulloch, Check list Fish. Austral. III, 1929, p. 345.
Salarias lineatus Whitley, Sci. Rept. Great Barrier Reef Exp. IV (9), 1932, p, 298.
Salarias lineatus Giltay, Mem. Mus. Roy. Hist. Nat. Belg. Hors Ser. V (3), 1933, p. 102.
Salarias lineatus Herre, Jour. Pan-Pacific Res. Inst. VIII (4), 1933, p. 11.
Salarias lineatus Herre, Fishes Herre Phil. Exp., 1934, p. 97.
Salarias lineatus Smith, Jour. Siam. Soc., Nat. Hist. Suppl. IX (3), 1934, p. 319.
Salarius lineatus Suvatti, Index Fish. Siam, 1936, p. 161.
Salarias lineatus Roxas and Martin, Check list Phil. Fish., 1937, p. 246.
Salarias lineatus Herre, Philip. Jour. Sci. LXX (4), 1939, p. 355.
Salarias lineatus Herre, Rec. Ind. Mus. XXXXI (4), 1939, p. 365.
Salarias lineatus Herre, Mem. Indian Mus. XIII (3), 1941, p. 395.
Salarias caudolineatus Herre, Philip. Journ. Sc. LXX, 1939, p. 354 (in part).

Salarias lineatus Schultz, Bull. U. S. Nat. Mus. CVIII, 1943, p. 282.
Salarias lineatus Blegvad, Danish Sci. Inv. Iran, Pt. III, 1944, p. 177.
Salarias lineatus Fowler, Proc. Acad. Nat. Sc. Philadelphia XCVII, 1945, p. 73.

D. XIII (rarely XIV). 21-23. A. II. 23-24. P. 14. V. I. 3.

Crest very large in largest males, as long as head without snout and half as high as long; top evenly rounded but posterior end protruding beyond base to a length equal to eye and nearly reaching first dorsal spine. No trace of crest in females. Nasal cirrus half pupil in length, palmately divided into 4 or 5 simple filaments, little longer than short pedicle (one female examined had right nasal cirrus simple.) Proximal $^2/_3$ of supraorbital cirrus broad and flat, the distal $^1/_3$ tapering to a fine point; 4 or 5 tiny, short filaments on either side; cirrus about $^2/_3$ height of eye in large specimens. No nuchal cirri. Forehead slightly protruding, most anterior point of snout even with lower margin of eye. Upper lip crenulate throughout length except at corners, but crenulation rather weak and irregular. Lower lip smooth. No canine teeth. Depth of body 6.3 to 7 0 in length. Length of head 4.7 to 4.8 in standard length. Anterior dorsal spines as high as anterior dorsal rays. Dorsal notch prominent but not reaching to base of fin; last dorsal spine short, buried at bottom of notch, but usually apparent. Last ray of dorsal bound to caudal peduncle by membrane which reaches over half of the secondary caudal rays, but not to first principle caudal ray. Longest pectoral ray shorter than head by length of snout. First anal rays not especially elongate or differentiated. *Male*: Crest with light vertical band, margined by darker and broad as eye across it a little ahead of its middle; band fanning out broader at top, and crest otherwise dusky; anterior dark margin of light band reaching down to posterior edge of eye; posterior dusky area of crest concentrating into narrow dark line below, which extends down over cheek to corner of mouth. Another similarly sharply defined, narrow, dark line extending from this point to postero-ventral corner of eye. A similar line from border of eye across upper lip, lower lip, and across chin to meet its mate on other side of head. Between these last two narrow dark lines a broad light band extends down from eye and across chin. Throat otherwise without spots or markings. A dusky spot, the size of pupil, directly behind eye; a half dozen similar, or smaller, spots on posterior cheek and opercle. Six pairs of sharply defined black spots, nearly as large as eye, along dorsal edge of body, and a seventh single spot at upper base of caudal. From each of these spots a dusky streamer ascends obliquely up onto dorsal fin. Six roughly parallel, narrow, black lines run the length of body; always definable. Top one connected to nearly all black spots at base of dorsal; second sends off secondary shoots, is somewhat irregular, and is more or less broken into spots on caudal peduncle; third extends straight through to base of caudal, although irregular and sending off shoots in middle of body; fourth straight, but terminating before caudal peduncle reached; fifth broken up into spots on caudal penduncle; sixth faint over abdomen, straight, and terminating at end of base of anal. In some specimens there are only five lines, the top two or three may be more or less joined into a network by anastomosing offshoots, and the lower two may be more or less broken into spots on the caudal peduncle. Spiny dorsal with oblique alternating dark and light bands from base to edge. Soft dorsal with basal two thirds similarly marked, but distal third consisting of a band of five or six alternating, very narrow, dark and light lines parallel with fin edge. Anal pale and without markings except for narrow, marginal black band. Pectoral clear, with a vertical white band across its base margined on either side by sharply defined, narrow dark lines. Pelvics light and without markings. Abdomen and ventral edge of body pale. An indistinct, double dark spot at base of middle caudal rays, surrounded posteriorly by broad light band which shades off into even duskiness of remainder of fin. No sharply defined spots on caudal or dorsal. *Female*: Abdomen and pelvics whiter than in male. Tips of anal rays white and only a narrow submarginal dusky band. Tips of dorsal rays also light and submarginal band dusky, but not made up of alternating light and dark bands. Both dorsals generally lighter in colour than in male.

Habitat: Singapore!; Sumatra!; Java! (Jacarta!); Bawean; Lombok!; Lembeh Straits!; Morotai!; Pulu Endu; Solor; Timor; Haruku; Saonek, Waigeu!; Biak!; Schouten Islands!; New Guinea (Manokwari). — Mombassa!, Djibuti!, Muscat!, Henjam Islands in Persian Gulf!, Sind!, Travancore!, Ceylon!, Madras!, Burma, Andaman Islands!, Christmas Island (Indian Ocean)!, Philippines!, Marianas Islands!, Marshall Islands!, Bismarck Archipelago!, N. Queensland!, New Caledonia!, Loyalty Islands!, Fiji Islands!, Samoa!, Tuomotu Islands.

Note: The type of *Salarias kingii* (Paris Museum 2048a) is a male *S. lineatus* 95 mm. long, badly discoloured and blackened, but with traces of the black horizontal lines remaining on the left side and the light oblique stripes showing on the dorsal. D. XIII-23, deeply notched and fully attached to caudal. A II-24, free of caudal peduncle. P. 14. V. I. 3, high crest with broad free flap behind. Nasal cirrus five-fid, short as pupil. Orbital cirrus scarcely half eye, with 4 or 5 simple filaments on either side. No nuchal cirri or canines. Upper lip strongly crenulate from corner to corner; lower lip smooth.

Day (1876) synonymized *S. caudolineatus* (= female *cyanostigma*) with this species, which is incorrect. He had described the former as a new species, *S. striolatus*. These two quite separate species (*S. lineatus* and *S.cyanostigma* female) have been much confused by authors because both have well marked, narrow, black lines horizontally on the sides. Herre had the two species mixed together in the material from which he drew his descriptions. This is one of the few species of Salariin blennies which appears to range unchanged from East Africa to the Marquesas.

7. **Salarias hasseltii** Bleeker

Salarias hasseltii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, pp. 238, 241, 257.
Salarias hasseltii Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, pp. 168, 170, 171, 178, 448.
Salarias hasseltii Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, pp. 403, 460.
Salarias hasseltii Günther, Cat. Fish. Brit. Mus. III, 1861, p. 258.
Salarias hasseltii Day, Fishes of India, 1876, p. 332.
Salarias hasseltii Günther, Journ. Mus. Godeffroy XIII, p. 210.
Salarias hasseltii Schmeltz, Cat. Mus. Godeffroy VII, 1879, p. 49.
Salarias hasseltii Pohl, Cat. Mus. Godeffroy IX, 1884, p. 34.
Salarias hasselti Seale, Occ. Pap. B. P. Bishop Mus. IX (1), 1906, p. 87.
Salarias hasselti Jordan and Seale, Bull. U. S. Bur. Fish. XXV, 1906, p. 430.
Salarias hasseltii Regan, Proc. Zool. Soc. London 1909, p. 405.
Salarias mccullochi Fowler, Proc. U. S. Nat. Mus. LXIII, 1923, p. 25.
Salarias mccullochi Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 441.
Salarias hasselti Whitley, Journ. Pan-Pacific Res. Inst. I (2), 1927, p. 7.
Salarias hasseltii Fowler, Mem. B. P. Bishop Mus. XI (5), 1931, p. 364.
Salarias hasselti Herre, Rec. Ind. Mus. XLI (4), 1939, p. 368.
Salarias multilineatus Fowler, Proc. Acad. Nat. Sci. Philadelphia XCVII, 1945, p. 68.

The present species differs in no anatomical detail from *Salarias lineatus*. The colour differences to be referred to bear no relation to sex or size. Furthermore specimens fitting this description have been examined from the Andaman Islands, Christmas Island (Indian Ocean), East Indies, Samoa, and the Phoenix Islands, all within the normal range of *S. lineatus,* which rules out the possibility of geographical variation. The chief difference between the two forms is that *hasseltii* has the black horizontal lines on the sides subdued or quite absent while in their place are pale horizontal lines of equal prominence. The following differences in colour pattern are to be noted on the unpublished colour plates of Bleeker's Atlas, in the Leiden Museum:

S. lineatus	*S. hasseltii*
1. Six dark oblique lines running to edge of spinous dorsal; base light, but edge evenly dark; area between dark bands evenly brown.	1. Outer edge of spinous dorsal pale yellow and unmarked; about 12 dark, oblique streaks on fin with light blue streaks of same width in between.
2. About 13 oblique dark streaks running to edge of soft dorsal, separated by pale streaks which are yellow basally and blue distally; no horizontal colour bar on fin.	2. Also about 13 dark streaks on soft dorsal, but not reaching edge of fin; edge of fin narrowly blue, with narrow submarginal line of black separating edge from pale yellow area to which oblique streaks reach but do not penetrate.
3. Caudal with dark blotch basally, then lighter crescent, then outer half of fin dark to edge.	3. Caudal with no dark basal spot; basal ¾ of fin evenly blue brown; outer ¼ pale yellow.
4. Head with numerous black dots, dashes and wavy streaks on snout, under eye, over whole side of head except lower opercle.	4. Head evenly dark, with only a single dark line curving down behind eye to corner of mouth.
5. Black lines on sides crinkly, anastomosing above, breaking up into dots and dashes on caudal peduncle, space between them light brown. Dorsal most 1 to 3 lines running into, and branching from, dorsal black blotches of vertical body bands.	5. Dusky (not black) lines on body straight and seldom anastomosing; lines between them bright yellow; the lines not breaking up into dots and dashes on caudal peduncle; no horizontal lines on ventral third of body; dusky horizontal lines not anastomosing with dorsal black blotches of vertical body bands.

When due allowance is made for the fading of tints in preservatives these differences can be followed in specimens preserved either five years or 100 years, the black lines of *S. lineatus* being remarkably persistent in preservatives. Bleeker's series of *S. hasseltii* from Cocos Island (Leiden Museum 4796), consisting of 18 specimens 48 to 84 mm long and containing both males and females, have the stripes on the sides indistinguishably faded. Recently collected specimens from several localities in Polynesia have the lower half of the cheeks uniformly silvery. While it would appear likely that this species is synonymous with *S. lineatus* the rather striking differences in the general appearance of two forms suggests the desirability of keeping them separated until ecological observations can be made.

An examination of the types of *S. mccullochi* in the U. S. Nat. Mus. and of *S. multilineatus* in the Philadelphia Academy of Sciences shows both to be based on females of the *hasseltii* form. Other females of this form in the latter museum are identified as *S. lineatus*.

8. **Salarias fasciatus** (Bl.)

Blennius gattorugine Forskål, Descr. Animal. 1775, p. 23 (not of Linneaus).
Blennius fasciatus Bloch, Naturgesch. Ausländ. Fische II, 1786, p. 110.
Salarias quadripennis Rüppell, Atlas Reise N. Afrika, Fische des rothen Meeres, 1828, p. 112.
Salarias quadripinnis Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 318.
Salarias fasciatus Cuvier and Valenciennes, ibid., p. 324.
Salarias quadripinnis Bleeker, Verh. Bat. Gen. XXIII, 1849, Bijdr. Kennis Blennoïd. p. 19.
Salarias priamensis Bleeker, Nat. Tijdschr. Ned. Indië IV, 1853, p. 268.
Salarias fasciatus Günther, Cat. Fish. Brit. Mus. III, 1861, p. 244.
Salarias quadripinnis Jouan, Mem. Soc. Sc. Nat. Cherbourg. XII, 1866, p. 126.
Salarias fasciatus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 491.
Salarias lineolatus Alleyne and Macleay, Proc. Linn. Soc. New S. Wales, I, 1877, p. 336.
Salarias fasciatus Day, Fishes of India, Part II, 1876, p. 330.
Salarias fasciatus Günther, Jour. Mus. Godeffroy, XIII, 1877, p. 201.
Salarias fasciatus Kossmann and Räuber, Verh. Naturh. Med. Vereins Heidelberg I, 1876, p. 29. — Zool. Ergebnisse, 1877, p. 20.
Salarias brasiliensis Sauvage Bull. Soc. Philom. Paris (7) IV, 1880, p. 217.
Salarias fasciatus Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 10.
Salarias griseus De Vis, Proc. Linn. Soc. N. S. Wales, VIII (4), 1884, p. 450.
Salarias pauper De Vis, ibid., IX (3), 1884, p. 695.
Salarias sublineatus De Vis, ibid., IX (3), 1884, p. 695.
Salarias furvus De Vis, ibid., IX (3), 1884, p. 696.
Salarias ceramensis Jordan and Snyder, Proc. U. S. Nat. Mus. XXV, 1902, p. 458 (not of Bleeker).

Salarias fasciatus Garman, Bull. Mus. Harvard Coll. XXXIX (8), 1903, p. 238.
Salarias fasciatus Jordan and Seale, Bull. U. S. Bur. Fish. XXV (1905) 1906, p. 427.
Alticus griseus Jordan and Seale, ibid., p. 424.
Salarias fasciatus Jordan and Richardson, ibid. XXVII (1907), 1908, p. 284.
Salarias fasciatus M. Weber, Siboga Exp. Fische, 1913, p. 529.
Alticus griseus Ogilby, Mem. Queensland Mus. III, 1915, p. 135.
Alticus pauper Ogilby, ibid., p. 135.
Alticus sublineatus Ogilby, ibid., p. 135.
Salarias fasciatus McCulloch and McNeill, Rec. Austr. Mus. XII, 1918, p. 10.
Salarias fasciatus Fowler and Bean, Proc. U. S. Nat. Mus. LXII, 1922, p. 72.
Salarias fasciatus McCulloch, Rec. Austr. Mus. XIV, 1923, p. 123.
Salarias fasciatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 435.
Salarias fasciatus lineolatus Whitley, Great Barrier Reef Exp. Sc. Rep. IV (9), 1932, p. 298.
Salarias fasciatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 408. — Philip. Journ. Sc. LXX, 1939, p. 349.

D. XII. 18-20. A. II. 19-21. P. 14. V. I. 2.

No trace of crest on head in either sex. Nasal cirrus a little shorter than pupil, stubby, 1 to 3 short filaments on either side of pedicle and as many as 6 or 7 borne palmately at its end; number of filaments and length of pedicle increasing somewhat with age, but organ always multifid. Supraorbital cirrus a little less than $^1/_2$ eye in length, bushy, 2 or 3 filaments coming from common base which are not only multifid but their sub-filaments often secondarily divided. Nuchal cirrus no longer than pupil, bushy, at least 15 filaments to each cirrus and these secondarily divided until in large specimens there may be as many as 30 filaments; all filaments coming from a single, broad pedicle, but this may be split almost to the base. Forehead rounded and receding a little from vertical. Both lips smooth but in largest specimens fine and irregular serrations are noted under magnification on upper lip. No canines. Depth 4.3-4.8. Head 4.3-4.8. Lateral line curving down behind pectoral and ending there. No trace of notch in dorsal although last spine is often a little shorter than first ray, leaving a slight jog in fin. Last 2 spines of equal length. Membrane connecting last dorsal ray to caudal peduncle covers all of small caudal rays and the ray is either completely bound down, or only tip is free. First few rays of adult male greatly elongated, with membrane deeply excised between them. Last anal ray half bound to caudal peduncle by membrane. Longest pectoral ray shorter than head by length of snout and half the eye. *Male*: A vertical dark band along preopercular margin; a similar one around corner of mouth to eye.

Several small dark spots on top and back of head; a few larger dark spots on upper lip and under eye. Throat nearly black, with a narrow, light band across its posterior third, usually traces of another light band across the middle, and an incomplete similar band behind the lip (the latter always noticeable at corner of mouth). A light spot across lower lip at symphysis and usually 3 or 4 incidental light spots on dark of throat. Base of pectoral and breast prominently reticulated with dark lines which enclose oval light spots, at least one of which is as large as eye. Anterior part of abdomen crossed by a single or double dark line; second vertical dark band of side sometimes nearly meeting across abdomen behind this. Vertical dark bands of body chiefly noted as 8 pairs of black spots at the base of dorsal, which extend briefly onto fin; bands more or less lost in other coloration on sides. Area above lateral line speckled thickly with small black dots against tan background. Middle of sides from under pectoral to half way back under soft dorsal occupied by 10 or 12 sharply defined black lines that are more or less broken, and become lines of dashes dorsally. On back behind these dashes a line of from 3 to 7 sharply defined black spots, and above this a line of 1 or 2 more dots. Four to 10 more diffuse and larger dots on caudal peduncle. General body colour brown and underlying all the pattern noted above are round light spots the size of pupil or smaller. Under the striped area they may be faded in some specimens, and posteriorly they may coalesce to form light area between the vertical body bands, but along and above the base of the anal these light spots are always prominently developed. Dorsal fin profusely covered by tiny black specks which are more or less gathered, on the spinous dorsal, into broad reticulating bands which enclose light spots the size of pupil. Anal dusky on basal third, a little lighter distally; always a scattering of black dots like those on caudal peduncle over posterior third of fin. Caudal light, sprinkled with small dark dots which may be profuse or scattered, but always present. Pectoral prominently marked by black spots on rays. These may be confined to basal half of fin or extend out to edge, but some are always prominently present except in specimens from Solomon Islands. Ventrals crossed by three dark bands. *Females*: Same as males.

Habitat: Singapore!; Sumatra (Trussan, Ulakan, Priaman); Batu Islands; Nias; Biliton; Krakatau!; Java (Jacarta, Prigi); Duizend Islands!; Bawean; Borneo!; Bali; Celebes! (Makassar, Badjoa, Menado, Tombariri); Sangi Islands; Talaut Islands!; Sula

Islands!; Binongka; Ternate; Buru; Obi; Ceram; Ambon!; Nusalaut!; Goram; Gebe!; Sumba!; Siau! Flores; Roma!; Rotti!; Timor!; Tiur!; Kei Islands! — Johanna Island!; Red Sea!; Madagascar!; Kenya!; Seychelles!; Persian Gulf; Coast of India; Andamans; West Coast of Malay Peninsula!; China Coast!; Pulu Condor; Annam!; Philippines!; Formosa; Ryu-Kyu Islands!; Marianas Islands!; Solomon Islands!; Santa Cruz Islands!; Great Barrier Reef, Australia!; Carolines; New Hebrides; New Caledonia!; Fiji Islands; Tonga Islands; Samao!; Tuamotu Islands!. In sea.

9. **Salarias ceramensis** Bleeker

Salarias ceramensis Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, pp. 690, 692, 701,

Salarias ceramensis Günther, Cat. Fish. Brit. Mus. III, 1861, p. 246.

Salarias ceramensis Meyer, Anal de la Soc. Esp. de Hist. Nat. XIV, 1885, p. 31.

Salarias ceramensis M. Weber, Siboga Exped. Fische, 1913, p. 529.

Salarias ceramensis Herre, Fishes Herre 1931 Phil. Exp., 1934, p. 96. — Philip. Journ. Sci. LXX (4), 1939, p. 349.

D. XII. 18. A. II. 19. P. 15. V. I. 2.

No trace of crest in either sex. Nasal cirrus equal to pupil in length; a flattened, thin pedicle bearing at its end 4 or 5 pointed filaments equal in length to pedicle. Supraorbital cirrus $^2/_3$ eye in height; a thick, flattened core, half length of organ, with about 15 slender filaments, all of about equal length, around its complete edge. Nuchal cirrus like that over eye except central core broader and thicker, the filaments thicker and only 7 or 8 in number, and most of filaments secondarily branched. Forehead prominent, but inclining back a little from vertical. Both lips smooth, but a few very shallow and small irregularities visible on upper lip under magnification. A tiny canine just emergent from membranes, posteriorly on each dentary. Depth 3.3-3.5. Head 3.7-4.5. Lateral line curving down behind pectoral, where it disappears. Dorsal beginning far forward, a little ahead of vertical from preopercle edge; no notch in dorsal, which is highest in middle of soft dorsal; last spine no shorter than next preceding; tips of spines free from membrane but those of rays not, except for first 3 or 4; last dorsal ray completely bound to caudal, membrane covering first large ray of caudal and extending unto next. First few anal rays of male somewhat lengthened and membrane more deeply excised between them than between remaining rays; spines both tiny and somewhat buried at base of first ray; first spine of female completely buried in genital papilla of female; last anal ray $^1/_2$ to $^2/_3$ attached to caudal peduncle by membrane. *Male*: A circle of 10 or 11 small dark spots around perimeter of iris of eye. Three or 4 similar spots behind eye; 3 on upper end of preopercle; several scattered on top of head, the cheeks and upper lip. Head, throat, and body deep chocolate brown. Vertical dark bands of body apparent only as 2 darker round spots the size of eye, one over middle of pectoral, the other over end of pectoral. Numerous small spots like those of head scattered over body; dorso-anteriorly they are black, postero-ventrally they are light, and particularly noticeable along base of anal. Abdomen lighter than back and thickly sprinkled with small, blue-black spots. First dorsal spine crossed by 4 dark spots; rest of dorsal more or less uniformly coloured; basal third of fin dark and opaque, with smaller, darker spot between each spine and ray; middle of fin light and somewhat translucent; outer edge of fin dark again; whole fin mottled with fine dark and light punctulations which are especially prominent distally and disappear proximally. Caudal dusky, mottled with many irregular, light punctulations which are not gathered into bands or other regular patterns. Anal coloured like dorsal except that it is darker, which obscures middle light area; first 3 long rays pale. Each pectoral ray with 4 to 6 prominent black spots. Base of pectoral uniformly dark brown with this colour extending over base of middle rays, obscuring dark spots. Ventrals crossed by 5 narrow, dark bars. *Female*: Like male, except first few anal rays not pale.

Habitat: Singapore; Java (Jacarta!); Borneo!; Celebes (Menado, Tamawako); Sulu Islands!; Ceram; Buru; Ambon; Tau!; Schouten Islands; — Pelew Islands!; Solomon Islands!; Philippine Islands!; Madras?

10. **Salarias sexfilum** Günther

Salarias sexfilum Günther, Cat. Fish. Brit. Mus. III, 1861, p. 241.
Salarias guttatus M. Weber, Siboga Exp. Fische, 1913, p. 530 (not of C. and V., in part).
Salarias (*chrysospilus* Blkr.?) M. Weber, Siboga Exp. Fische, 1913, p. 531 (not of Bleeker).

D. XII. 17-18. A. II. 19. P. 14. V. I. 2.

A well formed crest nearly as high as eye posteriorly in large males (only half as high as eye in females); crest becoming apparent at 25 mm. length in small specimens. Nasal cirrus simple, lanceolate, a little longer than pupil. Supraorbital cirrus very slender, a little longer than eye, simple (not forked at end). Nuchal cirrus slender, simple and about $^1/_2$ length of supraorbital cirrus. Forehead nearly vertical. Both lips smooth. A small canine posteriorly on each dentary. Depth 4.1-4.8. Head 4.8-6.0. No notch or change of level between spinous and soft dorsals; last dorsal spine only slightly shorter than first ray; membrane from last ray covering all first small caudal rays. Anal spines tiny and almost buried against base of first ray; first two anal rays of male elongate, the membrane more deeply excised between them than the remaining rays; basal $^1/_3$ of last ray membraneously attached to caudal peduncle. *Male*: A ring of white spots around under side and back of eye. White spots thickly scattered over lower half of head and throat. Throat dark, the white spots gathered together in a short bar at middle of throat and along white line submarginal to edge of gill membranes; no big blue gular spots as in *S. guttatus*. Several large white blotches on base of pectoral with several tiny white dots above and over base of rays. Seven pairs of vertical dark body bands, broad and more or less joined together at the bottom, split dorsally and tapering up unto body to end at upper $^1/_3$ of back, with a black dot above each point, the lot forming a horizontal row of dots along upper part of sides. No trace of body bands on back, but a number of dark dots in no particular pattern just under spiny dorsal, and a few under soft dorsal. Black dots and dashes under pectoral and on flanks so characteristic of *S. guttatus* not present. Small circular white dots (not oval or elongate as in *S. alboguttatus*) scattered all over body and particularly noticeable ventrally, except on abdomen. Spinous dorsal with 4 white lines sloping backward and down, with wider dark bands between them. Soft dorsal with 2 to 4 white dots on each ray forming irregular oblique lines which slope backward and down. Bottom half of caudal thickly dotted with white, the dots not in bands; upper half of fin clear. Anal unspotted, but brown toward edge. Two vertical dark bands across pectoral. Pelvics crossed by dark band at base. *Female*: Like males.

Habitat: Sanana, Sula Besi Island!; Lucipara Island!; Sumba!.

11. **Salarias guttatus** C. V.

Salarias guttatus Cuvier and Valenciennes, Hist. Nat. Poissons XI, 1836, p. 308.
Salarias celebicus Bleeker, Nat. Tijdschr. Ned. Indië VII, 1854, p. 250.

Salarias irroratus Alleyne and Macleay, Proc. Linn. Soc. N. South Wales I (4), 1877, p. 337.
Salarias harmandi Sauvage, Bull. Soc. Philom. Paris (7) IV, 1880, p. 219.
Salarias griseus De Vis, Proc. Linn. Soc. N. South Wales VIII, 1880, p. 450.
Salarias undecimalis Jordan and Seale, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 800.
Salarias guttatus M. Weber, Siboga Exp. Fische, 1913, p. 530.
Salarias guttatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 436.
Negoscartes irroratus Whitley, Sci. Rept. Great Barrier Reef Exp. *4* (9), 1932, p. 298.
Salarias guttatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 409.
Salarias guttatus Herre, Philip. Journ. Sc. LXX, 1939, p. 362.
Salarias guttatus Herre, Rec. Indian Mus. XLI, part IV, 1939, p. 370.

D. XII. 17-18. A. II. 18-19. P. 14. V. I. 2.

No free crest in either sex, but on adult males a low fleshy ridge no higher than broad extends back to first dorsal spine. Nasal cirrus lanceolate, simple, with a constricted base, and as long as pupil. Supraorbital cirrus constricted at base, widening to slender lanceolate shape, no filaments on side but tip bifid, with branches secondarily split in large specimens, as long as eye. Nuchal cirrus constricted at base, broad and leaf-like above, either ragged at end or with 2 or 3 short distal filaments. Forehead definitely projecting with a concavity between it and the upper lip. Both lips smooth. A short, blunt canine posteriorly on each dentary, barely projecting through membrane. Depth 5.0-5.4. Head 4.5-4.8. Spinous dorsal lower than soft dorsal; actually only slight notch between two, but last spines become progressively shorter so that the appearance of a shallow notch is given; membrane from last ray reaching just to the first small rays of caudal. All rays of male anal elongate with membrane between them deeply excised, but 3d to 6th rays exceptionally elongate, being as long as head and a little longer than greatest depth of body. First few rays of female anal not especially elongate. Last anal ray partly bound to caudal peduncle by membrane. Longest ray of pectoral shorter than head by length of snout and $^2/_3$ eye. *Male*: A narrow black band as long as eye on vertical arm of preopercle. Numerous small, round, light spots on cheek. A light streak from eye across corner of upper lip to join white of throat. Upper lip pale; lower lip narrowly dusky. A characteristic dark spot the size of eye on either side of throat, which is bright blue in life; throat between, around and behind these spots light. Base of pectoral with 2 characteristic, sharply defined white spots $^2/_3$ the size of eye and one behind the other. Two or 3 small, diffuse light spots like those of cheek above these. Lips of anus white, but around them is a blue-black spot the size of eye which shades into darkness of abdomen anteriorly. Vertical dark body bands almost completely obscured. Body thickly covered with black dots that are round or vertically elongated; extremely thick anteriorly and dorsally; more thinly scattered on lower part of side and over anal. A characteristic horizontal row of small, round, white spots directly at base of anal. A single row of small, black dots on upper side which are somewhat obscured by the dots around them in well coloured specimens, but are a characteristic feature which remain evident in badly faded specimens. A dark spot the size of pupil on lower half of 2nd, 5th, 8th and 12th dorsal spine. Many small indistinct dark spots on lower $^2/_3$ of dorsal making this part of fin dusky, shading gradually into clear margin. Three to 4 tiny black spots on each dorsal ray forming lines parallel to edge of fin. Basal $^2/_3$ of soft dorsal more or less mottled and generally dusky; distal $^1/_3$ clear. No oblique bands on fin. Anal fin generally dusky; a dark spot at base of each ray; a second row of spots further out on fin anteriorly. Black dots of body continuing over base of caudal and out along middle 4 or 5 rays, fading out ventrally; dorso-posterior quarter of fin completely clear. An imperfect double row of spots across the lower and basal half of pectoral, which is otherwise clear. Ventrals dusky but unmarked. *Female*: Vertical dark bands of body more distinct, consisting of mesial spots as large as eye, forked both above and below; throat more dusky around blue spots; anal with definite submarginal dark band; otherwise like male.

Habitat: Singapore!; Batu Islands; Celebes (Manudju, Menado, Kema); Island Barang near Macassar!; Saleyer!; Samau!; Sulu Islands!; Buru; Obi Major!; Sangir Islands!; Talaut Islands!; Ambon; Waigeu!; Nusa Laut!; Rotti!; Kei Islands! — Philippines; Solomon Islands!; New Hebrides! Santa Cruz Islands!; Great Barrier Reef, Australia!; Vavau!; Andamans?. In sea.

12. **Salarias mülleri** Klunzinger (Fig. 49, p. 323)

Salarias Mülleri Klunzinger, Sitzber. Akad. Wien LXXX, 1 Abth., 1880, p. 388.
Salarias mülleri M. Weber, Siboga Exp., Fische, 1913, p. 535.
Salarias mülleri McCulloch and McNeill, Rec. Austr. Mus. XII (2), 1918, p. 16.
Salarias mülleri McCulloch, Mem. Austr. Mus. V (3), 1929, p. 344.
Salarias oortii Herre, Notes Fish. Zool. Mus. Stanford Univ., 1934, p. 97.
Salarias oortii Herre, Philip. Journ. Sci. LXX, 1939, p. 356 (not of Bleeker).
Istiblennius mülleri Whitley, Austr. Zoologist X (2), 1943, p. 186.

D. XII or XIII. 19-22. A. II. 22-23. P. 14. V. I. 3. (last ray visible only by dissection).

Crest $^1/_2$ eye in height, $1^1/_2$ eye in length, lowest anteriorly, posterior end somewhat rounded and projecting beyond base; present in both sexes. Nasal cirrus slender, simple, pointed, and about as long as pupil. Supraocular cirrus simple, flattened, and wide proximally tapering sharply distally; $^2/_3$ eye in height. No nuchal cirri. Forehead definitely projecting. Both lips smooth. No canines. Depth 4.8-6.0. Head 4.0-4.8. Both dorsals about equal in height and nearly as high as greatest depth of body; deeply notched, with last spine about $^1/_3$ height of next preceding and $^1/_5$ height of first rays; membrane of last dorsal ray covering all of secondary caudal rays, but ray so long that distal half projects freely. First few anal rays not especially elongate. Longest pectoral ray shorter than head only by length of very short snout. *Male*: Posterior edge of crest narrowly dark brown. Head and throat light brown, without markings. No trace of normal body bands. Body, however, uniformly covered with numerous dark vertical bands, which are so broken up caudally that they cannot be accurately counted, but with about 15 on middle half of sides; each a little wider than intervening light band; reaching from dorsal to ventral edge of body, except over unmarked abdomen, and not extending up on base of dorsal; each light in middle ventrally, giving appearance of being deeply forked; a tendency to break up into spots dorsally; variously curved and broken up into spots and lines on caudal $^1/_4$ of body. Dorsals translucent. Spinous dorsal crossed obliquely by 5 pairs of narrow dark lines; no spots or other markings. Soft dorsal with 5 similar pairs of oblique line on anterior half; first extends from last spine to edge of fin; remainder grow progressively shorter until last is noticeable only at base of fin. This leaves basal $^2/_3$ of fin clear for most of its length. Distal $^1/_3$ of fin occupied by 5 or 6 parallel

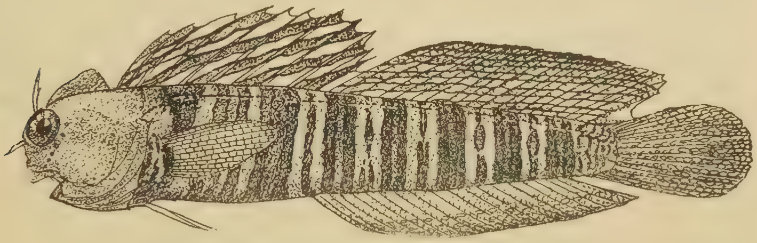

Fig. 49. *Salarias mülleri* Klz. × 1½.

narrow, dark lines which are nearly parallel the edge of fin, and only slightly oblique. This band of lines occupies entire edge of soft dorsal and is prominent. Membrane, outer half, and base of caudal reticulated with fine brown lines, enclosing numerous small, oval, clear spaces. Anal dusky without spots or markings, and not translucent like dorsals and caudal. Pectoral translucent and unmarked. Ventrals dusky but unmarked. *Female*: Like male but body profusely spotted with dark dots posteriorly.

Habitat: Talaut Islands!; Sula Islands!; Ambon!; Kiur! — Philippines (Mindoro!, Zambales!); Hobson's Bay (Victoria)?.

13. **Salarias goesii** Bleeker

Salarias Goesii Bleeker, Act. Soc. Sc. Indo-Neerl. VI, 1859, Bijdr. Vischfauna N. Guinea, p. 19. — Nat. Tijdschr. Ned. Indië XX, 1859-60, p. 93 (compiled).
Salarias goesii Günther, Cat. Fish. Brit. Mus. III, 1861, p. 253 (compiled).
Salarias Goesii Bleeker, Arch. Neerl. Sc. Neerl. XIII, 1878, p. 54 (compiled).
Salarias goesi Jordan and Seale, Bull. U. S. Bur. Fish., XXV, 1906, p. 431 (compiled).
Salarias goesi Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 443.
Salarias colei Herre, Fishes Herre Phil. Exp., 1934, p. 96.
Salarias colei Roxas and Martin, Check list Phil. Fishes, 1937, p. 245 (compiled).
Salarias colei Herre, Philip. Journ. Sci. LXX (4), 1939, p. 351 (on types).
Salarias martini Herre, Proc. Biol. Soc. Wash. LV, 1942, p. 2.

D. XIII (rarely), XIV-XV. 17-20. Anal II. 19-21. P. 14. V. I-3.

Crest in male $^2/_3$ eye in height, $1^1/_3$ eye in length; anterior edge low and concave so that rounded posterior part almost as high as long. No crest in female, or only a low fold of skin in large specimens. Nasal cirrus shorter than pupil, bearing 2, 3 or 4 simple filaments palmately. Supraorbital cirrus slender, not more than $^2/_3$ eye in height, bearing 3 to 5 tiny filaments on either side. No nuchal cirri. Forehead slightly receeding. Both lips smooth. No canines. Depth 5.6 to 5.7. Head 4.3 to 4.6. Lateral line ending behind pectoral. Spinous dorsal lower than soft dorsal; fin notched about half way to base; last spine half length of next but buried in bottom of notch and scarcely visible without dissection; membrane from last dorsal ray reaching to, but not unto, first small rays of caudal. First few anal rays not especially elongate or otherwise modified; last ray free from caudal peduncle. Longest pectoral ray shorter than head by length of snout. *Male*: General coloration dusky, without sharply defined markings, but with definite colour pattern. Six or 7 faint pale spots on crest. An indistinct dusky bar behind eye; cheek mottled. A faint pale bar from eye down across both lips at corner of mouth. Two pale streaks across upper lip near its middle and a median one on lower lip. Throat evenly dusky. Body with six broad vertical dark bars, all more or less double, all slightly forked ventrally; bands darkest at base of dorsal, onto which they extend slightly; a short, narrow, dark bar mesially between each of main bands; seventh bar at base of caudal single. Both dorsals with indistinct wavy lines ascending postero-dorsally; without definite spots; margin of both dorsals white. Anal uniformly dusky, with tips of rays pale. Caudal with an incompletely double dark spot at base of middle rays; surrounding this is a broad pale crescent; remainder of fin dusky; no other spots or markings. Base of pectoral with a broad, dark vertical band, then a narrow light band, then a dusky area across base of rays; two, broad, dusky bands across fin. Abdomen and ventral edge of body posteriorly pale. In old males the top of head and all vertical fins may be almost uniformly black. *Female*: Like male except generally lighter, with vertical body bands standing out more clearly.

Habitat: Doreh, New Guinea! — Philippines (Culion!, Estanciaon Panay!).

Note: The type (Leiden Museum 4659) is in poor shape, has been partially dessicated at some time in the past, and has the abdomen greatly distended and hard. It, however, fits the above description, which was based on the types of *S. colei* augmented by an examination of the types of *S. martini*. It has D. XIV-18; A. II-20; P. 14; V. I-3. Traces of 2 or 3 dark bands across the pectoral remain; there are no canines; the nasal and supraorbital cirri bear filaments; no nuchal cirri; caudal free from dorsal. The most unusual thing about this species is the high number of dorsal spines and the great variability in both the number of dorsal spines and rays. Of 26 specimens counted there were the following numbers of dorsal spines and rays: XIII = 2; XIV = 23; XV = 1; 17 = 1; 18 = 4; 19 = 20; 20 = 1. Of anal rays there were the following: 19 = 6; 20 = 14; 21 = 6. It resembles in many ways the following species, from which, however, it is easily distinguished.

14. **Salarias dussumieri** C. V.

Salarias dussumieri Cuvier and Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 310.

Salarias Oortii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 257. — Acta Soc. Sc. Indo-Neerl. III, 1858. Zesde bijdr. vischf. Sumatra, p. 39.

Salarias olivaceus Blyth, Journ. Asiat. Soc. Bengal. XXVII (3), 1858, p. 271.
Salarias dussumieri Günther, Cat. Fish. Brit. Mus. III, 1861, p. 252.
Salarias striato-maculatus Kner and Steindachner, Sitzber. Akad. Wien, LIV, 1866, p. 368.
Salarias dussumieri Playfair, Fishes of Zanzibar, 1866, p. 77 (in part).
Salarias dussumieri Day, Fishes of India, part II, 1876, p. 333.
Salarias geminatus Alleyne and Macleay, Proc. Linn. Soc. N. S. Wales I, 1877, p. 336.
Salarias auridens Alleyne and Macleay, ibid. p. 338.
Salarias cristiceps Alleyne and Macleay, ibid. p. 338.
Salarias striato-maculatus Bleeker, Versl. Akad. Amsterdam, XII, 1878, p. 197.
Salarias doliatus Sauvage, Bull. Soc. Philom. Paris (7) IV, 1879, p. 217.
Salarias Cheverti Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 12.
Salarias striato-maculatus Sauvage, Poissons de Madagascar, 1891, p. 522.
Salarias Steindachneri Pfeffer, Jahrb. Hamburg Wiss. Anst. X, 1892, p. 142.
Salarias zamboangae Evermann and Seale, Proc. U. S. Nat. Mus. XXXI, 1907, p. 512.
Salarias barbatus Gilchrist and Thompson, Ann. S. Afric. Mus. VI (2), 1908, p. 108.
Salarias dussumieri Gilchrist and Thompson, Ann. S. Afric. Mus. VI (2), 1908, p. 109.
Salarias striato-maculatus M. Weber, Siboga Exp. Fische, 1913, p. 531.
Salarias striato-maculatus de Beaufort, Bijdr. Dierk. Afl. XIX, 1913, p. 149.
Salarias dussumieri McCulloch and MacNeill, Rec. Austr. Mus. XII (2), 1918, p. 18.
Salarias dussumieri Barnard, Ann. S. Afric. Mus. XXI, 1925-27, p. 846.
Salarias dussumieri Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 439.
Salarias dussumieri Giltay, Mem. Mus. Royal Hist. Nat. V, 1933, p. 102.
Salarias dussumieri Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 503.
Salarias dussumieri Hugh Smith, Journ. Siam Nat. Hist. Suppl. IX (3), 1934, p. 320.
Salarias siamensis Hugh Smith, loc. cit.
Salarias dussumieri Hora and Mukerji, Rec. Indian Mus. XXXVIII, 1936, p. 33.
Salarias zamboangae Herre, Philip. Journ. Sc. LXX, 1939, p. 359.
Salarias dussumieri Herre, Rec. Indian Mus. XII (4), 1939, p. 367.

D. XIII (rarely XIV). 21-23. A. II. 23-25. P. 14. V. I. 3.

Crest on male about $^{2}/_{3}$ eye in height, $1^{3}/_{4}$ eye in length, evenly rounded on top with a posterior lobe projecting beyond base. No trace of crest on female. Nasal cirrus $^{1}/_{2}$ pupil in length, consisting of a broadened flap which is more or less frayed at the edge and usually bearing one to several filaments. Supraorbital cirrus with filaments off each side, increasing from 1 to 5 with age; old males with some of filaments secondarily divided so that cirrus appears bushy; length varying with age, from half diameter of eye to a little longer than eye. No nuchal cirri. Forehead approximately vertical.

Both lips smooth. Upper lip somewhat offset on lateral quarters so that when mouth is closed the middle of the upper lip overlaps the lower lip, while laterally the lips meet smoothly. No canines. Depth 5.8-6.5. Head 4.8-5.3. Spinous dorsal a little lower than soft dorsal and curves down posteriorly so that notch between two is both wide and deep; last dorsal spine $^2/_3$ height of next, strong, recurved, but somewhat hidden in the folds at bottom of notch. Membraneous connection of last dorsal ray extending over all small caudal rays to reach and partially cover first large caudal ray. First anal rays not modified; last free from caudal peduncle. Longest pectoral ray shorter than head by length of snout. *Male*: Crest dusky anteriorly and posteriorly pale in middle half. Top and sides of head somewhat mottled with lighter, but no prominent markings. Tips of supraorbital filaments white. Corner of mouth pale, and this streak of light passes across chin to other side. Two other light patches, indistinctly defined, on upper lip, with a darker streak between them mesially and also posteriorly between each and corner of mouth. Throat reddish-brown, relieved by lighter mottling but with no strong markings. Body generally dusky above and light below. Vertical body bands distinct above and below, but often dim on sides, appearing dorsally as 7 pairs of black spots the size of eye at base of dorsal and extending up on dorsal a little; pairs united on middle of sides, deeply and narrowly forked ventrally where they extend almost to base of anal, standing out prominently; each ventral fork lighter in its middle, giving appearance of secondary furcation; usually secondary, short, vertical bands of dark between main vertical bands. A grouping of 10 to 20 round dark spots on the caudal peduncle which may be in irregular double lines, or more usually scattered without pattern, is distinctive of the species and remains even in badly faded specimens. Spinous dorsal with dark, wavy, parallel lines, sloping down posteriorly; these often fade completely; usually a black spot between first two spines. Basal half of soft dorsal almost black, relieved by some mottling anteriorly; distal half clear, but crossed by several narrow, oblique, dark lines; edge of fin dark. This same coloration carries over onto dorsal half of caudal where the edge is dark, there is a broad inner clear band crossed by lines of darker, and the basal part of fin is again dark; lower half of fin more or less uniformly dusky. Anal fin dusky, lighter proximally, darker distally. Pectorals and ventrals light and unmarked. Base of pectoral indistinctly mottled with light. *Female*: Essential colour pattern of male present although many more dark spots on caudal peduncle. Fin colour strikingly different. Dorsals, caudal, anal and pectoral clear and covered with many small black spots. These arranged in bands which slope downward posteriorly on spinous dorsal; only roughly gathered into bands on soft dorsal; a pair of dark dashes at base of middle rays of caudal, and the fin crossed by 4 or 5 vertical rows of spots; distal edge of anal membrane bearing a black spot between each of first 10 to 12 rays, tips of rays white; lower half of pectoral crossed by 2 or 3 widely spaced rows of black dots. The dusky peritoneum is noticeably through the abdominal wall in both sexes

Habitat: Singapore!; Java (Jacarta!); North Celebes!; Lembeh Straits!; Banda!; Pulu Endu; New Guinea (Sorong!) — Portuguese East Africa!; Madagascar!; Natal!; Zanzibar!; Persian Gulf!; Seychelles Islands!; Kurrachee!; Malabar!; Travancore!; Madras!; west side Andaman Islands!; Malay Peninsula! Siam!; Hainan!; Philippines!; Pelew Islands!; New Caledonia!; Marianas; Coast of Queensland; Samoa; Society Islands. In sea.

Note: *Salarias doliatus* is recorded as having been taken by Quoy and Gaimard in the Atlantic Ocean. The type (Paris Museum 2548) is a typical male *S. dussumieri* and could scarcely have been taken in the Atlantic. The form of *S. dussumieri* which occurs in the Western Indian Ocean is sufficiently different from more eastern forms to probably warrant the retention of a subspecific designation: *S. d. striatomaculatus*. An examination of the type series of *S. oortii* (Leiden Museum 4791); shows that with one exception, they fit precisely the description of *S. dussumieri* as given above. Even what colour pattern remains (the pale middle area of the soft dorsal continued onto top of caudal remains) is that of *dussumieri*. The exception is that these specimens have small canines posteriorly in the lower jaw. Two specimens from Moscos Islands, South Burma and one from Frigate Island, Seychelles, have been found to be typical *dussumieri* except for possessing tiny canines. The conclusion is inescapable that *S. dussumieri* occasionally has small canines and that this is merely an individual, and rather rare, variation of that species. Herre's specimens of *oortii* from the Philippines were *S. Mülleri*. Günther's specimens of *oortii* from Java were *S. edentlus*.

15. **Salarias edentulus** (Bl. Schn.)

Blennius edentulus Bloch Schneider, Syst. Ichth. 1801, p. 172.
Salarias rivulatus Rüppell, Atlas Reise N. Afrika, Fische des rothen Meeres, 1828, p. 114.

Salarias forsteri Cuvier and Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 315.
Salarias quadricornis Cuvier and Valenciennes, ibid., p. 329.
Blennius truncatus Forster Lichtenstein, Descr. Animal., 1841, p. 231.
Salarias melanocephalus Bleeker, Verh. Bat. Gen. XXIII, 1849. Bijdr. Kennis Blenn. p. 18.
Salarias Forsteri Bleeker, Nat. Tijdschr. Ned Indië I, 1850, p. 255.
Salarias sumatranus Bleeker, l.c., p. 256.
Salarias quadricornis Peters, Monatsber. Akad. Berlin, 1855, p. 441.
Salarias diproktopterus Bleeker, Nat. Tijdschr. Ned. Indië XIII, 1857, p. 69.
Salarias edentulus Günther, Cat. Brit. Mus. III, 1861, p. 252.
Salarias quadricornis Günther, ibid. p. 255.
Salarias oortii Günther, ibid., p. 257 (not of Bleeker).
Salarias edentulus Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 293.
Salarias truncatus Bleeker, Acta Soc. Indo-Neerl. VIII, 1860, Achtste bijdr Vischf. Sumatra, p. 44.
Salarias quadricornis Kner, Novara Exp. Fische I, 1865-1867, p. 197.
Salarias quadricornis Klunzinger, Verh. zool. bot. Ges. Wien. XXI, 1871, p. 486.
Salarias edentulus Günther, Fische der Südsee II, 1876, p. 206.
Salarias quadricornis Günther, ibid. p. 209.
Salarias quadricornis Day, Fishes of India, Part II, 1876, p. 331.
Salarias melanocephalus M. Weber, Jenaische Denkschr. VIII, 1895, p. 108.
Salarias edentulus Steindachner, Denkschr. Akad. Wien. LXX, 1900, p. 499.
Salarias basiliscus Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII (4), 1904, p. 552.
Salarias edentulus Jordan and Evermann, Bull. U. S. Fish. Comm. XXIII (1903) 1905, p. 503.
Salarias rivulatus Jordan and Seale, ibid. XXV (1905) 1906, p. 429.
Salarias edentulus Jordan and Seale, loc. cit.
Salarias quadricornis Steindachner, Sitzber. Akad. Wien, 1906, p. 1411.
Salarias rivulatus Jordan and Richardson, Bull. Bur. Fish. XXVII, 1908, p. 284.
Salarias edentulus Jordan and Richardson, l. c.
Salarias quadricornis Gilchrist and Thompson, Ann. S. Afric. Mus. VI (2), 1908, p. 108.
Salarias edentulus Kendall and Goldsborough, Mem. Mus. Comp. Zool. XXVI (7), 1911, p. 328.
Salarias edentulus Kendall and Radcliffe, ibid. XXXV (3), 1912, p. 158.
Salarias quadricornis Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 519.
Salarias sumatranus M. Weber, Siboga Exp. Fische, 1913, p. 531.
Salarias rivulatus M. Weber, l. c., p. 534.
Salarias rivulatus McCulloch and McNeill, Rec. Austr. Mus. XII, 1918, p. 15.
Salarias rivulatus Barnard, Ann. S. Afric. Mus. XXXI, 1925-1927, p. 845.
Salarias edentulus Fowler and Bean, Proc. U. S. Nat. Mus. LXXI, Art. 10, 1927, p. 13.
Salarias edentulus Fowler, Mem. B. P. Bishop, Mus. X, 1928, p. 437. — Proc. U. S. Nat. Mus. LXXX, 1932, p. 15. — ibid. LXXXVI, 1934, p. 502.
Salarias edentulus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 407.
Salarias edentulus Fowler, Monogr. Acad. Nat. Sc. Philadelphia II, 1928, pp. 82, 186.

Salarias edentulus Whitley and Colefax, Proc. Linn. Soc. New S. Wales LXIII, 1938, p. 298.
Salarias edentulus Herre, Philip. Journ. Sc. LXX, 1939, p. 357. — Rec. Indian Mus. XLI, Part IV, 1939, p. 368.
Salarias edentulus Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 282.
Salarias fluctatus Fowler, Proc. Acad. Nat. Sci. Philadelphia, XCVII, 1945, p. 70.
Salarias edentulus Fowler, Proc. Acad. Nat. Sc. Philadelphia XCVII, 1945, p. 73.

D. XIII. 19-21. A. II. 21-23. P. 14. V. I-3.

Crest well developed in male, $^2/_3$ eye in height sloping up gradually from front to highest point over posterior end; posterior end sharply rounded and projecting somewhat beyond base. No crest in female. Nasal cirrus of 3 to 5 slender filaments of approximately the same length borne palmately on a short pedicle, the whole organ about equal to the pupil in length. Supraorbital cirrus simple, nearly equal to eye in height and tapering to a point from a rather broad base (occasional large specimens, or specimens with an injured cirrus, with an irregular filament on one or the other supraorbital cirri). Nuchal cirrus slender, simple, pointed and equal to pupil in length. Cirri of female generally more slender and shorter than in male. Forehead gently rounded and not projecting. Both lips smooth. No canines. Depth 3.6-5.4. Head 5.0-5.6. Dorsals approximately equal in height; notched to a little more than $^1/_2$ their depth, with last spine about $^1/_3$ length of first ray; membrane from last ray covering all secondary rays of caudal and reaching onto first large caudal ray, leaving only distal fifth of dorsal ray free. First few anal rays of large males occasionally somewhat swollen and crenulated. Longest pectoral ray a little shorter than head. *Male*: The coloration is variable with age and among specimens from a single collection. There are no prominent markings that are always present, and the males are normally drab. The young have vertical black bands normally present on the body but in older specimens these may quite disappear. Old specimens are frequently uniformly dark all over except for the ventral side of the body which is paler. Frequently there is a dark line behind the eye, which may have a silvery posterior border, and a dark dash down from the eye to the upper lip. When they are not obscured by melanism, there are normally several pale horizontal lines on the spiny dorsal and oblique lines on the soft dorsal; the lines may be broken into spots and dashes. Ordinarily the caudal is plain dusky but in paler specimens there may be traces of two indistinct broad dusky bands across it. The anal is normally plain with a dark submarginal band, but there may be two or three horizontal lines of pale dots. The pectoral is dusky but unmarked; the ventrals are paler, and unmarked. *Female*: In the Pacific Ocean the females differ from the male strigingly in coloration in that the body is generally paler, the dorsal fins, the base of the caudal and the posterior half of the body are covered thickly with prominent, small, black spots that are persistent in preservation.

Habitat: Sumatra (Benkulen, Trussan, Ulakan, Priaman, Siboga); Nias; Banka!; Biliton; Java (Palabuan Ratu, Triperwageran, Bantam, Prigi, Pagotang, Patjitan, Karong bolong); Bawean; Lombok!; Paternoster Islands!; Celebes (Mamudju, Tombariri, Menado); Lembeh Straits; Sulu Islands; Talaut Islands!; Buru; Ambon; Haruku; Ceram!; Flores!; Solor; Samau!; Timor; Aru Islands; Schouten Islands; Waigeu!; New Guinea (Manokwari). — Coasts of East Africa!; Red Sea; Arabian Coast!; Madagascar!; Seychelles!; Réunion!; Mauritius!; Coasts of India!; Ceylon; Nicobars; Cocos Keeling Islands; Paracels Islands; China!; Philippines!; Pelew Islands!; Marianas!; Carolines!; Solomons!; New Hebrides!; Fiji; New Caledonia!; Coasts of Queensland; Norfolk Island; Lord Howe Island!; Samao!; Phoenix Islands!; Tuamotus!; Tahiti!.

Note. The forms of this species which inhabit southern Japan, Hawaii, and the Marquesas Islands are probably sub-specifically distinct and are not included in the synonymy given above. The female of the species throughout the greater part of the Pacific range is heavily spotted, and this is the form which Bleeker described as *S. sumatranus* and that has been recorded repeatedly in the literature as *S. rivulatus*. In the Indian Ocean the female typically does not have this spotting and is little different in coloration from the male. Some spotting is occasionally present on Indian Ocean females; and females have been observed without such spotting from the East Indies. *S. diproktopterus* (Leiden Museum 4468) is a female of this species with an injured anal fin, split to the base in the middle, and completely healed over, with no sign of any rays being missing. Nuchal cirrus multifid, supraorbital cirri and nasal cirri present and simple; no canines; dorsal broadly attached to caudal; D. XIII-20; A. II-21. Such injuries to fins are not uncommon. One specimen from the Philippines had the caudal fin missing and the dorsal rays growing down over the stump; another had the two dorsals completely separated b.

a healed-over injury. Occasionally the supraorbital cirrus may have been injured and in regeneration have acquired one or two irregular filaments. The type of *S. fluctatus* Fowler (Phil. Acad. 71603) is a typical dark male of this species with supraorbital and nuchal cirri simple, no canines, D. XIII-20, A. II-22, and the lips smooth.

16. **Salarias cyanostigma** Blkr

Salarias cyanostigma, Bleeker, Verh. Bat. Gen. XXII, 1849, pp. 5, 7, 18.
Salarias andamensis Day, Proc. Zool. Soc. London, 1869, p. 611.
Salarias andamensis Day, Fishes of India, 1876, p. 332.
Salarias striolatus Day, Fishes of India, 1876, p. 333.
Salarias caudolineatus Günther, Jour. Mus. Godefroy XIII, 1877, p. 209.
Alticus caudolineatus Jordan and Seale, Bull. U. S. Bur. Fish. XXV, (1905) 1906, p. 423.
Rupiscartes caudolineatus Fowler, Bull. B. P. Bishop Mus. XXII, 1925, p. 36.
Salarias caudolineatus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 441.
Salarias caudolineatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 406. — Philip. Journ. Sc. LXX, 1939, p. 354 (in part).
Salarias lineatus Herre, ibid. 1939, p. 355 (in part).
Salarias striolatus Herre, Rec. Ind. Mus. XLI (4), 1939, p. 365.

D. XIII. 18-21. A. II. 20-22. P. 14. V. I. 3.

A well-developed crest on male beginning between eyes and sloping up gradually to highest point at posterior end; a strong posterior lobe extending beyond base; about 2/3 height of eye in specimens of moderate size. Crest always present in females, a little lower than in males of same height, but 2/3 height of eye in largest specimens available. Nasal cirrus 1/2 to 2/3 pupil in length consisting of 3 or 4 short slender filaments of equal length borne on a short pedicle. Supraorbital cirrus slender, rod-like, simple, tapered to a point, 1/2 to 1 eye diameter in length; not noticeably longer in males than females; one male examined had that on right eye briefly bifurcate at tip, all other specimens had organ simple. No nuchal cirri.

Forehead definitely projecting beyond vertical from upper lip. Both lips smooth for full length. A single, well-developed, recurved, pointed canine on either side below fitting into cavity in roof of mouth when mouth closed. Depth 5.0 to 6.3. Head 4.1 to 5.3. Spinous dorsal a little lower than soft dorsal, about equal in both sexes. A distinct notch in dorsal; last spine about 1/2 height of preceding spine, 1/3 that of first ray and more or less hidden in membranes at base of notch. Last ray of dorsal bound to caudal peduncle by a membrane which covers half to all of secondary caudal rays but does not reach base of first primary ray. Longest pectoral ray shorter than head by length of snout and half the eye. First few anal rays not especially modified or lengthened. Male: Middle third of crest lighter than anterior and posterior thirds but borders between light and dark not sharply defined, or crest uniformly pale. Upper part of head rich brown, lower part shading off into creamy tan. A dark, vertical streak across middle of snout and upper lip; behind this a light streak runs from front of eye across upper lip; this followed a parallel light and then dark streak from lower margin of eye across lip. Light streak pronounced across corner of mouth, continuing across throat directly behind sharply black, narrow edge of lower lip; light streak continues more faintly around posterior margin of eye, over top of head, and spreads out to form light middle third of crest. A somewhat oblique black-rimmed white dash at postero-ventral margin of orbit. A smaller, but always prominent, similar dash behind this with a distinctive, round, black dot directly above it. A black dot often at posterior dorsal margin of orbit. An irregular, very prominent, black spot about size of pupil at upper corner of operculum (center may have been white in life). Usually a smaller, similar dot below it, partially or wholly detached, but never such a dot above it and never a black spot on shoulder between opercular spot and dorsal fin. A large dusky spot present on throat under corner of jaws on either side. Remainder of gill membrane creamy tan with an irregular dorsal extension of this colour on lower cheek. Operculum and adjacent branchiostegal membranes darker. Numerous white specks, not arranged in regular pattern, on lower part of cheek and base of pectoral. Base colour of body a light, creamy tan and ventral side of body without other coloration. Nine vertical dark bands on body which stand out sharply. First partially double, with a light spot in center, and not extending below top edge of pectoral. Next five forked below and either forked above or enclose a round light spot dorsally. Seventh and eighth bars partially united dorsally and not extending as far ventrally as others. Ninth bar a simple saddle over caudal peduncle at base of caudal rays. On fourth through ninth bar a black-rimmed dash of white. Above this on fifth through seventh bar a similar spot. These spots forming 2 parallel, longitudinal lines on body as in *S. periophthalmus*; numerous similar, black-ringed white spots normally scattered profusely over posterior part of body above, below and in between these rows. Three fine black longitudinal lines on middle of sides crossing third and fourth vertical body bars and intervening light space. Middle line always interrupted in its middle and may be otherwise broken. All three lines always present, always sharply defined, and no other horizontal lines on body.

Except for blotches at base from vertical body bands, basal half to two-thirds of spinous dorsal clear in strong contrast to dark brown dorsal half. Dark half crossed by indistinct, incomplete, wavy white lines parallel to fin edge; narrow edge of fin white. Basal $^2/_3$ of soft dorsal clear except for narrow dark streamers arising obliquely from each half of vertical body bars. Outer $^1/_3$ dark brown with some indistinct white parallel lines, and tips of rays light. Anal increasingly dusky distally, without markings. Base or middle caudal rays with two short, parallel, horizontal dark bars surrounded by light crescent. Fin crossed by five bands of dark spots which are prominent dorsally but faded ventrally. Pelvics and pectorals unmarked. *Female*: General colour pattern pale yellowish brown with most of dark markings standing out sharply against it. A short, horizontal bar of white edged with black behind eye and even with its lower border. A broad bar of light from lower margin of eye across lips, chin, and up to eye on other side. Lower lip, except for light band at corners, narrowly edged with dark brown. Throat otherwise dusky mesially, lighter laterally and without other markings. Low crest dusky. A narrow wavy pale line joining posterior edges of eyes across head at front of crest; two similar transverse lines at its posterior end, ending in upper cheek. Faint traces of dark opercular spot.

Seven dark spots along base of dorsal, first six double or nearly so; from them the rather faint vertical bands descend over side. Three sharply penciled, very prominent black lines extending horizontally on body from level of tenth dorsal spine to about the level of the tenth dorsal ray, from whence they continue to base of caudal as short bars or spots. Between each two of these three stripes anteriorly a row of dark bars appearing as secondary broken stripes. Top line occasionally partially broken into dashes; bottom line solid in specimens from Indian Ocean.

Each dorsal spine with 1 or 2 dark spots which form horizontal lines when fin erected; fin membrane clear except for dusky submarginal band. Each dorsal ray bears 2 or 3 sharply-defined dark spots so that fin has 2 and a partial 3d horizontal row of spots when erected; membrane clear except for dusky submarginal band. Caudal crossed by 5 to 8 (usually 6) rows of sharply-defined dark spots; membrane clear. Anal mostly clear, a dusky submarginal band with tips of rays white. A sharply-defined dark spot on membrane near base of fin between each two rays except first 4 or 5. Base of pectoral finely dotted with brown punctulations which extend onto base of rays; pectorals and pelvics otherwise unmarked. Abdomen and ventral edge of body pale.

Habitat: Sumatra! (Cauer, Priaman); Java (Pagotong!, Karangbollong, Palabuan Ratu, Triperwageran); Ternate; Sangir—Andaman Islands!; Philippines!; Solomons!; New Hebrides!; Fiji!; Samoa!; Tuamotus!

Note. The male of this species has been consistently confused with *S. periophthalmus* and *S. bilitonensis* by recent authors. No attempt has been made to correct these in the synonymy listed above. The type bottle (Leiden Museum) contained specimens of six species of this general relationship. All of the other specimens were tied together in a string except 1, a male 67 mm long (81 mm including the caudal). This is undoubtedly the type (it is the only one of the specimens corresponding in length to the measurement given by Bleeker). While it is in poor condition and partly discoloured the high crest, 3 short horizontal black lines on sides, numerous auxiliary, black-circled spots on the body posteriorly, etc., define it as this species. There is no nuchal cirrus, the supraorbital cirrus is simple, the lips are smooth, there is a well developed canine. As in all of the species in this direct relationship, there is a high degree of sexual dimorphism in coloration and the strikingly coloured female has been described separately as *S. striolatus* and *S. caudolineatus*. There are minor colour pattern differences between the Indian Ocean and Pacific Ocean forms.

17. **Salarias bilitonensis** Bleeker

Salarias bilitonensis Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 231.
Salarias Hendriksii Bleeker, ibid. p. 233.
Salarias fronto Günther, Cat. Fishes. Brit. Mus. III, 1861, p. 255.
Salarias bilitonensis Günther, ibid., p. 257.
Salarias periophthalmus var. Kner, Sitzber. Akad. Wien. LVIII. 1. Abth. 1868, p. 333.
Salarias bilitonensis Day, Fishes of India, Part II, 1876, p. 334.
Entomacrodus leopardus Fowler, Journ. Acad. Nat. Sci. Philadelphia (2) XII (4), 1904, p. 554 (not of Day, nor of Fowler 1938).
Entomacrodus calurus Fowler, ibid. p. 555.
Salarias deani Jordan and Seale, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 799.
Salarias Hendriksii M. Weber, Siboga Exp. Fische, 1913, p. 533.
Salarias bilitonensis M. Weber, ibid., p. 535.
Alticus novemmaculosus Snyder, Proc. U. S. Nat. Mus. XXXV, 1908, p. 107.

Alticus novemmaculosus Snyder, Proc. U. S. Nat. Mus. XLII, 1912, p. 518.
Salarias interruptus de Beaufort, Bijdr. Dierk. Afl. XIX, 1913, p. 149 (not of Bleeker).
Salarias bilitonensis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 442.
Salarias periophthalmus var. *visayanus* Herre, Notes Fishes Zool. Mus. Stanf. Univ., 1934, p. 97.
Salarias deani Herre, ibid., p. 97.
Salarias periophthalmus var. *visayanus* Herre, Philip. Journ. Sc. LXX (4), 1939, p. 353. (in part).
Salarias deani Herre, ibid., 1939, p. 365.

D. XIII. 20-21. A. II. 20-21. P. 14. V. I. 3.

Crest in male rounded and varying from height of pupil to nearly height of eye; no trace of crest in female. Nasal cirrus with three or four slender filaments of equal length borne palmately on a short pedicle on tube of anterior nostril. Supraorbital cirrus very slender, simple, pointed, and a little longer than diameter of eye. No nuchal cirri. Forehead strongly projecting, with most anterior point of head opposite eye. Both lips smooth. A single, tiny canine, usually less than $^1/_3$ diameter of pupil in height on either side below. Lateral line straight. Depth 6.0 to 6.4. Head 4.2 to 5.0. Dorsal distinctly notched but last spine $^2/_3$ height of next and plainly visible. Dorsals about equal in height in males, spinous dorsal a little lower in females. Membrane from last dorsal ray covering first two secondary caudal rays but not reaching onto first principal ray. Longest pectoral ray shorter than head by length of snout and half the eye. First few anal rays not especially elongate or otherwise modified. *Male*: A triangular blue-black spot nearly as long as eye present at upper corner of opercle. A tiny black dot between this spot and origin of dorsal, but never a black spot below large spot. Two narrow dashes of white, edged with black on cheek behind eye, the upper one vertical, the lower one oblique. A narrow dash of white, edged with black at postero-ventral rim of orbit. A broad band of light coming from eye across lips which contains two round dots edged with black on upper lip. Ahead of this a diffuse dark band extends from eye across the lips, then another light band and a mesial dark band. Head otherwise generally dusky; throat only a little lighter and without markings except for narrow edge of dark on lower lip. Dark vertical body bands well defined on middle of sides; furcate below and faint; furcate above to enclose circular light area. A horizontal dash of white, edged with black on lower edge of each of 3 to 5 middle bands where they start to fork, and a similar dash on at least 2 or 3 middle bands at beginning of dorsal fork; most of white center usually faded in dashes of dorsal row, leaving black bar. About 8 narrow, parallel, black lines extending along sides from beneath pectoral to level of last third of anal where they break up into lines of faint white dots; lines faint but always distinguishable; one or two occasionally broken but never running together as in *S. lineatus*.

Spinous dorsal dusky to very dark; some indistinct mottling at base by end of vertical body bands and a few wavy dark lines parallel to edge, but no sharply defined spots or bands. Proximal half of soft dorsal always lighter than distal half, and often clear; traversed obliquely by sharply defined, narrow, dark bands, one from each fork or adjacent vertical body bands; outer half of fin dark brown, this area closely packed with oblong spots of darker brown, the spots arranged parallel to edge of fin, with very thin lines between them. Caudal fin dusky except for clear outer edge; thickly sprinkled with small white dots not arranged in bands; and with 2 to 4 longitudinal white lines each lying on membrane between rays of middle of fin. Anal light proximally, shading to black edge. Pectorals clear and light with 6 or 8 small black dots irregularly arranged on outer half of middle rays. Ventrals pale like adjacent abdomen, and unmarked. *Female*: Female very different from male in colour pattern. Only 2 dashes behind eye remaining of black and white spots and dashes on cheek. Vertical body bands as sharply defined and heavily pigmented below as mesially. No trace of two rows of black-rimmed white spots or narrow dark lines, so distinctive of males, on sides. Upper ends of vertical body bands showing as distinctive pairs of black spots at base of dorsal, but do not send dark streamers up over fin as in male. Two or three sharply defined black dots on each spine and ray of dorsal, some of which are joined across intervening membrane by dark line; membrane otherwise clear, except for submarginal, narrow, dusky band on spinous dorsal. Caudal crossed by five, sharply-defined bands of black dots. Outer half of pectoral crossed by 1 to 5 incomplete rows of dark dots; always some dots, usually many. Anal rays dusky; a dusky submarginal band; tips of rays white.

Habitat: Sumatra (Padang); Biliton!; Talaut Islands!; Huisman Island!; Java (Anjer); Sulu Islands; Celebes!; Waigeu!; Schouten Islands!; — Philippines!; China!; Ryu-Kyu Islands!.

Note. In common with other species of this relationship *S. bilitonensis* shows a high degree of sexual dimorphism in colour pattern. Like the other species it is normal that whenever collections of more than one specimen are taken both sexes will be represented and usually in about the same numbers. This is also traceable in the literature. Bleeker described *bilitonensis* (the male) and *hendriksii* (the female) from the same collection. Fowler had the male as *E. calurus* and the female as *E. leopardus* from the same collection. De Beaufort had the male as *bilitonensis* and the female as *interruptus* from the same collection. Herre had the male as *S. periophthalmus visayanus* and the female as *S. deani* from the same collection. Snyder alone recognised the sexes as being of the same species in his *Alticus novemmaculosus*.

The female bears a superficial resemblance to female *S. dussumieri* from which it can be easily told by the simple supraorbital cirrus, shorter attachment of dorsal to caudal, spots on pectoral, lack of sharply-defined black spots on the body posteriorly, etc.

Borodin's Tahiti record is certainly in error, as Fowler points out.

18. **Salarias bleekeri** new species

Salarias periophthalmus Day, Fishes of India, 1876, p. 33 (not of C. V.).
Salarias periophthalmus Day, Fauna Brit. India., Fishes II, 1889, p. 318 (not of C. V.).
Salarias periophthalmus Herre, Rec. Ind. Mus. XLI (4), 1939, p. 363, (not of C. V.).
Salarias periophthalmus Herre, Mem. Ind. Mus. XIII (3), 1941, p. 395, (not of C. V.).

D. XIII. 19-20. A. II. 20-21. P. 14. V. I. 3.

A low crest on head of males, less than pupil in height but always present and as a flap, thinner than wide. Nasal cirrus consisting of 2 or 3 slender filaments borne palmately on a short pedicle. Supraorbital cirri slender, simple, and scarcely half the eye in height. Nuchal cirri slender, simple and less than half height of supraorbital cirrus, but always present. Forehead strongly projecting. Lips both smooth. Canines in lower jaw. Depth about 6.0. Head about 4.7. Spinous dorsal only a little lower than soft dorsal; a deep notch between the two, but last spine plainly visible. Membrane from last dorsal covering secondary caudal rays, but not reaching first principle ray. Longest pectoral ray shorter than head by length of snout. First anal rays of normal length and not specially modified. *Male*: Iris with five oval black spots on upper half. Numerous regularly spaced black spots on the head which were apparently all white centered in life. These are: a tiny dot at postero-dorsal corner of orbit, an oblique dash under eye, two tiny dots near corner of upper lip, an oblong spot on cheek below level of lower border of eye, a tiny dot above it, a large vertically oblong spot, longer than eye, on opercle, and a small round spot above it at beginning of lateral line. Head brownish with numerous tiny white punctulations on lower cheek, area under eye and lower opercle. Throat pale and unmarked except for narrowly dark edge of lower lip. Two lines of black rimmed silvery bars on side as in *S. periophthalmus* but the one in the dorsal series over the third bar in ventral series surrounded by a characteristic large black spot always noticeably larger than those of other bars. Vertical body bands pronounced on middle of sides and noticeable at base of dorsal, but otherwise faint or indistinguishable. Body tan to ruddy brown, shading to silvery on abdomen and throat. Posterior quarter of body with many tiny white dots as in *S. interruptus*, male. Spinous dorsal nearly uniform ruddy brown with pale edge or, in pale specimens, slightly mottled with indistinct dusky spots on spines. Soft dorsal rather clear basally with dusky streamers ascending obliquely across clear area from ends of vertical body bands. Outer third of fin occupied by about three rows of large oval spots between the rays, the rows parallel to edge of fin, the thin lines between the spots becoming silvery posteriorly. Caudal somewhat lighter above than below generally well pigmented. White dots of caudal peduncle continuing out on fin chiefly as six or seven horizontal lines, one each between two rays. Anal pale basally, shading into dark distally. Pelvics and pectorals unmarked. *Female*: General colour pale. A black spot smaller than pupil behind and on level with lower edge of eye. Lower lip narrowly dark. No other marks on head or throat. Last third of body (behind first third of anal) rather thickly set from top to bottom with small, round, dark spots, about 40 in number, not set in any pattern, and extending out onto base of caudal. No definite trace of vertical dark bands or other markings on body. Dorsal spines each with 2 or 3, and rays with 3 or 4, small dark spots, some spreading onto membranes. Caudal crossed by 5 lines of small dark spots. Anal with 3 dark dots on membrane between each pair of rays, forming 3 horizontal bands of dots, the distal of which is more or less joined into a submarginal line by additional pigment; tips of rays pale. Pectorals unspotted.

Habitat: Sumatra!; Huisman's Island! — Andaman Islands!.

Note. This well-marked species has not formerly been distinguished from *S. periophthalmus* and *S. bilitonensis*. Described from the type, a male 43 mm. long collected at Port Blair, South Andamans, Stanford Natural History Mus. 37136 (recorded by Herre as *S. periophthalmus*), and the following paratypes: 1 male collected by Kellers at Sumatra (U. S. Nat. Mus. 88014), 11 specimens collected by Captain Hodges in the Andamans and recorded by Day as *S. periophthalmus* (Indian Museum 291), 1 male collected in the Andamans and reported by Day as *S. periophthalmus* (Indian Museum 2047), 1 sp. collected by Bleeker in "East Indies", and in the type bottle of *S. cyanostigma* (Leiden Museum 4794), 2 females (upon which the above colour notes on the females is based) in the Amsterdam Museum as *S. hendriksii* from Huisman's Island; and 6 specimens from the same collection listed as *S. periophthalmus*.

19. **Salarias interruptus** Bleeker

Salarias interruptus Bleeker, Nat. Tijdschr. Ned. Indië XIII, 1857, p. 68.
Salarias Schultzei Bleeker, Nat. Tijdschr. Ned. Indië XIX, 1859, pp. 333, 345.
Salarias schultzei Günther, Cat. Fish. Brit. Mus. III, 1861, p. 240 (compiled).
Salarias interruptus M. Weber, Siboga Exp. Fische, 1913, p. 533.
Salarias interruptus Fowler, Mem. B. P. Bishop. Mus. X, 1928, p. 443.
Salarias periophthalmus (not of C. V.) Herre, Philip. Journ. Sci. LXX, 1939, p. 352 (in part).
Salarias interruptus Herre, Philip. Journ. Sci. LXX, 1939, p. 364.
Salarias deani Jordan and Seale, Bull. U. S. Bur. Fish. XVII, 1908, p. 284 (not of Jordan and Seale, 1905).

D. XIII. 19-20. A. II. 20-22. P. 14. V. I. 3.

A very low crest on head in adult males, never more than a raised ridge no higher than wide, and scarcely noticeably in half grown males; no trace of crest in female, midline of head slightly concave instead. Nasal cirrus consisting of two or three slender filaments of about equal length borne palmately on a short pedicle on top of tubular anterior nostril. Supraorbital cirrus slender, simple, pointed, and equal to, or slightly less than, height of eye. No nuchal cirri. Forehead definitely projecting. Both lips smooth. A small canine, about as long as pupil, on either side below. Depth 6.0 to 6.3. Head 4.5 to 5.0. Spinous dorsal lower than soft dorsal; notch between them no more than $^{1}/_{3}$ depth of next to last spine. Membrane from last ray reaching to secondary caudal rays, but scarcely upon them. Longest pectoral ray shorter than head by length of snout and half the eye. First few anal rays not especially elongate or otherwise modified. *Male*: General colour of head and body dark, reddish-brown without ventral edge of body or abdomen being markedly lighter. A small black spot directly behind top border of eye; occassionally faded or obscured. An oblique bar of white, rimmed with black, on cheek even with lower border of eye. A sharply-defined black spot the size of pupil at upper corner of operculum; above it a much smaller black spot at start of lateral line, which is occasionally faded. Lower cheek with numerous, tiny, pale dots. The throat uniformly dusky with lower lip narrowly darker still. Nine vertical dark bands across body, first only visible dorsally and last three reduced to narrow bars on upper half of caudal peduncle. Light space between each pair of bars on middle of body with a characteristic round dark spot in its middle with a thread of darker pigment connecting it to darker area of back. Each of these middle bars divided dorsally and ventrally with square middle section more heavily pigmented than the forks. Two parallel lines of white horizontal bars rimmed with black along sides, the spots in pairs one each at base of dorsal and ventral forks of body bands; white often gone, leaving bar black; lower line usually containing five bars, upper line with three or four, the first and last of the series often being lost. Vertical cross bands may be faded or obscured in some specimens but horizontal bars always present and always prominent. Spinous dorsal with narrow clear line at base, edge also narrowly clear; remainder of fin uniformly reddish brown with 3 or 4 distal dark spots on posterior half of fin. Basal half of soft dorsal crossed by series of dark oblique bands, one coming from each of dorsal forks of vertical body bands. Outer half of fin occupied by two dark bands parallel with edge of fin which are broken into round spots between rays. Membrane between markings mostly pigmented proximally, mostly clear distally. Caudal with narrow, dark streak horizontally along two middle rays. Margin of fin above clear; rest of fin quite dusky, shading into lighter area. Caudal peduncle, starting back even with 6th vertical body band, sprinkled with small round white spots; these continuing over caudal fin except for postero-dorsal clear area. Pectorals and pelvics dusky and without spots or markings. Anal dusky proximally, nearly black distally, tips of rays light, and no spots or markings. *Female*: Ordinarily much lighter than male. Blue black opercular spot, spot at beginning of lateral line, and usually spot at postero-lateral corner of eye, missing. Horizontal white bar under eye and on cheek present. Lower cheek pale but without pale dots. A dusky band running around corner of mouth and extending as broad dusky crescent on throat. Remainder of throat, except for narrowly dark lower lip, pale. Vertical body bands less distinct than horizontal markings. No white centered bars on side. Three to five irregular lines of prominent, dark, horizontal bars on sides from under pectoral to caudal. Lower line formed by a bar on each ventral fork of body bands. Next line up formed by longer bars, one each per body band at base of ventral fork. Two or three sharply defined black spots on each spine and ray of dorsal, the membrane clear, the remainder of rays and spines pale. Five or six rather irregular rows of sharply defined black dots across caudal. No white dots posteriorly on body or fins. Anal with a sharply defined black spot basally on membrane between each two rays except anterior three or four; a dark submarginal band with a partial second row of spots posteriorly partially included in band; tips of rays white; remainder of fin clear. Pectorals with a dusky ventral edge, but otherwise pale and unspotted. Ventrals pale and unmarked.

Habitat: Sula Islands!; Waigeu!; Buru (Kajeli!). — Philippines!; Solomons!; New Hebrides!

Note. The male of this species has ordinarily been included with *S. periophthalmus.* Bleeker described the sexes, which are strongly divergent as to colour pattern, as separate species, as he did all the forms related to *S. periophthalmus* and known to him. This species is confined to the south west Pacific, as far as is known. Herre's record from the Andamans was based upon another species.

20. **Salarias gibbifrons** Q. G.

Salarias gibbifrons Quoy and Gaimard, Voyage de l'Uranie et de la Physicienne. Zool., 1824, p. 253.
Salarias gibbifrons Cuvier and Valenciennes, Hist. Nat. Poissons XI, 1835, p. 312.
Salarias gibbifrons Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 256.
Salarias gibbifrons Günther, Journ. Mus. Godeffroy XIII, 1877, p. 205.
Salarias gibbifrons Fowler, Proc. Acad. Nat. Sc. Philadelphia, 1900, p. 517.
Salarias saltans Jenkins, Bull. U. S. Fish Comm. XII (1902), 1904, p. 508.
Salarias rutilus Jenkins, ibid, p. 509.
Salarias gibbifrons Jordan and Evermann, ibid. XXIII (1903) 1905, p. 499.
Alticus gibbifrons Jordan and Seale, ibid. XXV (1905) 1906, p. 423.
Salarias gibbifrons Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 437.
Salarias gibbifrons Fowler, ibid. XI (5), 1931, p. 364.
Salarias gibbifrons Fowler, Mon. Acad. Nat. Sc. Philadelphia II, 1938, p. 243.
Salarias gibbifrons Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 284.

D. XIII. 19-20. A. II. 20-21. P. 14. V. I. 3.

No trace of crest on head in either sex. Nasal cirrus slender, long as pupil; outer half split into three or four simple filaments of approximately equal length. Supraorbital filament as long as eye or a little longer, simple, slender, and sharply pointed. No nuchal cirri. Forehead strongly projecting with most anterior point of snout opposite eye. Both lips smooth. A single canine on either side below, no more than $^1/_2$ pupil in length and scarcely recurved. Depth 6.0 to 6.6. Head 4.1 to 4.7. Spinous dorsal a little lower than soft dorsal and the two separated by a deep notch. Last spine tiny, hidden in membranes at base of notch and no more than $^1/_5$ length of first ray. Membrane from last ray reaching to, but not onto, first small rays of caudal. Last ray of anal completely free from caudal peduncle. Longest pectoral ray a littly longer than postorbital length of head. Longest pelvic ray equals about $^3/_4$ postorbital length of head. Third pelvic ray long, extremely slender, bound tightly to second ray, and not visible without dissection. *Male*: Head, throat, base of pectoral and all of body except ventral edge of abdomen and along base of anal, covered with spots. Some of those on cheek nearly as large as pupil; elsewhere on head and throat spots much smaller. Spots on head brown, usually showing no trace of light center. Spots on body white, oblong horizontally and more or less arranged in longitudinal rows. No pronounced dark markings on head or throat except that lower lip is narrowly dark. Small dark spots evenly sprinkled over throat, without semblance of dark crossbands. Nine vertical dark body bands usually well defined, and all except first and last forked both above and below, the furcation being most prominent over abdomen. A very prominent black spot filling dorsal half of membrane between first two dorsal spines, and a less distinct spot between next two. Basal half of spinous dorsal mostly clear; outer half except for pale margin, pigmented, the pigmented band bearing a row, and a partial second row, of small white spots, the rows parallel with fin edge. Soft dorsal lightly and rather uniformly pigmented without definite dark spots, but with five longitudinal rows of small white spots, the rows parallel with edge of fin and most of spots borne on rays. Anal clear basally, shading into dark submarginal bands; tips of rays often pigmented but lighter than submarginal band. Caudal with a few faint dark spots mesially, faded above and below, middle of fin, and more broadly basally, with numerous well-defined, tiny white dots arranged in no regular manner. Pectoral with a few faded dark spots basally on middle rays and numerous white dots on rays basally; membrane clear. Pelvics white and unmarked. *Female*: Female looks quite different from male. Head coloured as in male but spots not clearly defined on top of head.

Small brown spots of throat and pectoral base sharply defined. First two vertical body bands not clearly defined but last seven are, and all are more deeply forked ventrally than in male. Back coloured as in male but no rows of oblong white spots on sides. Irregular vermiculated brown lines over abdomen, including lighter spots. Spot between first two dorsal spines smaller than in male, but just as sharply defined. Spinous dorsal with a faint longitudinal band basally. Each spine bearing two dark spots distally, forming a double submarginal row of spots parallel with edge of fin. Four similar, well-defined, rows of spots on soft dorsal; all of these spots more or less joined across membrane by pigment. No white spots on dorsals. Caudal crossed by seven vertical rows of sharply defined brown spots and without white spots. Pectoral with triangular patch of both brown and white spots which covers basal half of fin, leaving a broad marginal clear area around edge of fin. Pelvics light and unmarked. Anal with dark submarginal band; tips of rays white; a row of large dark spots basally made up of spots on the membranes between every other ray.

Habitat: Sumatra (Siboga!). — Hawaii!; Hull Island!; Swains Island!; Enderbury Island!; Marshall Islands!; Marcus Island.

Note. This well-marked species is known with certainty only from Hawaii and adjacent Polynesia and Micronesia. It is related to the *S. periophthalmus* group. It is very questionable that it is found in the Indo-Australian Archipelago. Bleeker's description of the specimens from western Sumatra, the only record of the species from the south-west Pacific, was incomplete and he mentions that the specimens were in poor condition. These same specimens have been examined (Leiden Museum 4789) and they are now in too poor a state to be identified except to this general relationship. No trace of colour remains. The heads have been partially dessicated at some time in the past and it is not possible to make out the character of the cirri clearly and definitely. The peritoneum is black.

Doubtful species

1. **Salarias raaltenii** Blkr.

Salarias Raaltenii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 257.

D. XIII. 20. A. 21. P. 13. V. 2.

Salarias with body elongate, height $5^3/_4$; head truncate, $5^1/_2$ in length of body, scarcely longer than high; diameter of eye 3 in length of head; forehead strongly convex; no occipital crest; tentacles...?; dorsal fin moderately notched between soft and spinous parts, spinous dorsal scarcely higher than soft dorsal and lower than body; soft dorsal much higher than the anal and not united with the caudal; pectorals and caudal obtusely rounded, $5\frac{1}{2}$; ventrals about 7 in length of body; middle anal rays about equal to others, first anal ray inserted about even with first dorsal ray. Colours?

Habitat: Java (Tjilankahan).

Note. This species is based on a drawing found among the papers of Kuhl and van Hasselt. It represents the contours of a fish 61 mm. long. No tentacles, crest or colour markings are indicated. It is impossible to say what species is represented. It is not even certain that it is a *Salarias*. Bleeker did not see a specimen.

2. **Salarias kuhlii** Blkr.

Salarias Kuhlii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 258.

D. XII. 16 (28). A. 18. P. 14. V. 2.

Salarias with elongate body, height 6 in its length; head truncate, $4^1/_2$ in length and a little longer than high; forehead strongly convex; diameter of eye about 3 in head; no occipital crest but in its place there is a number of short filaments; supraocular cirrus quadrifid and shorter than eye; dorsal fin unnotched, much lower than the head posteriorly, not united with the caudal; pectoral obtusely rounded, 7 in length; ventrals 8 in length; caudal obtusely rounded, 5 in length of body; anal lower than dorsal, lower edge convex. Colour ...? Length 77 mm.

Habitat: Java (Tjilankahan).

Note. This species is also based upon a crude outline drawing found among the papers of Kuhl and van Hasselt. Bleeker did not see a specimen. The species cannot be identified with certainty, and the genus is doubtful. It is probable that this is the Indo-Australian representative of *Blennius cristatus* L., which is known as *B. steindachneri* in the Indian Ocean and *B. tonganus* in Polynesia. The name *kuhlii* would have priority over the last two names for sub-specific designation, but the sub-species are based upon colour pattern differences chiefly, nothing is known about the colour pattern of *kuhlii*, no specimens of the genus *Blennius* have been recorded from the East Indies, and Java is on the border between sub-faunal areas so that no certain estimate could be made as to which sub-species of *B. cristatus* should be considered to be *kuhlii*. The latter name should be regarded as a *nomen nudum*.

3. **Salarias atratus** Macleay

Salarias atratus Macleay, Proc. Linn. Soc. New S. Wales VII, 1802, p. 361.

D. XII. 20. A. 19.

Height of body one-sixth of the total length. Head a little rounded and vertical in front. Eyes prominent, on the forehead, and about half their diameter apart; mouth small, at the inferior angle of the profile; dorsal fin profoundly notched, forming in fact two fins, the second portion extending on the caudal fin, the anal fin is like the second dorsal but not quite so high; the caudal fin is rounded at the extremity; the colour seems to have been black all over, slightly lighter on the breast. Length 75 mm.

Habitat: New Guinea (Moresby Bay).

Note. The above is copied from Macleay's description. Nothing is said about tentacles, lips and teeth so it is not possible to range this species among the others of the genus. Fowler (Mem. B. P. Bishop Mus. X, 1928, p. 443) places the species among the synonyms of *Enchelyurus ater* (Gthr.) but the deeply notched dorsal is a characteristic which makes Fowler's supposition improbable. It is likely that the species belongs with *Ecsenius*, and the high fin counts would range it with *E. pulcher*. However it is not possible to rationalize the fact that the soft dorsal count is greater than the anal count, a situation that exists in no species of the Salariin relationship. This is especially difficult in view of the fact that the anal count undoubtedly contains one or two anal spines.

7. **Rhabdoblennius** Whitley

Rhabdoblennius Whitley, Mem. Queensland Mus. X, 1930, p. 20.
Nixiblennius Whitley, ibid., p. 20.
Antennablennius Fowler, Proc. Acad. Nat. Sci. Philadelphia LXXXIII, 1931, p. 245.
Rhabdoblennius Norman, Ann. and Mag. Nat. Hist. (11) X, 1943, p. 809.

D. XII (rarely XIII). 17-22. A. II. 18-23. P. 14 (rarely 13). V. I-3.

Fleshy crest on head present or absent (absent in both sexes of Pacific species). Nasal, supraorbital and nuchal cirri always simple when present, except that supraorbital cirrus occasionally may be forked terminally in large specimens. Eyes far forward, forehead prominent, anterior profile approximately vertical, often concave between eye and lip. Both lips smooth, thin; a narrow flap of skin on outer side of lateral third of lower lip. Upper teeth usually 30 to 40, never more than 70; small, comb-like, somewhat movable, but never freely so as in typical Salariinae. Lower teeth 30 to 35, sturdier, scarcely (if at all) movable, much as in typical Blenniinae. Vomerine and upper canines absent; usually a small canine, less than diameter of pupil in length, below. A fleshy ridge behind mandibular teeth, hiding canine from lateral view. Depth 5.0 to 7.0. Head 4.3 to 5.4 (always a little longer than depth of body). Lateral line tubular anteriorly, with single row of pores; ending under spinous dorsal. Spinous dorsal little, or not at all, lower than soft dorsal; dorsal scarcely, or not at all, notched. Anal spines of male moderately long, not bearing dendritic masses or other modifications of a genital nature. Genital papilla of female more elongate and slender than in *Salariinae* and enclosing first anal spine, which shows only as a fleshy tip protruding from opening in papilla. Last anal ray membraneously attached to caudal peduncle. Pectoral pointed, the 9th or 10th ray from the top the longest. Caudal rounded to truncate, upper and lower rays never exerted; middle 9 rays branched. Third pelvic ray slender, curled under second ray. Gill membranes slightly attached to tip of isthmus, with broad free fold behind. Always some trace of six to eight dark vertical bars on body and base of dorsal. Head and body always with some black-rimmed, white-centered spots, these usually numerous and prominent.

Habitat: Indo-Western Tropical Pacific from East Africa to Samoa and north to southern Japan. About 9 species, of which 3 have been found in the Indo-Australian Archipelago.

Note. *Rhabdoblennius* may be considered to be somewhat intermediate between the Salariinae and Blenniinae (see Norman, 1943). The reduced number of dorsal spines, the partial attachment of the last anal ray to the caudal peduncle, the simple cirri, the prominent forehead, etc., suggest relationship with the species around *Salarias guttatus*.

Key to the Indo-Australian species of Rhabdoblennius

A. Nuchal cirri present.	
a. Supraorbital cirrus as long as diameter of eye and often twice as long. Dorsal fin noticeably notched between spinous and rayed parts	1. *Rhabdoblennius cornifer* p. 348.
b. Supraorbital cirrus tiny, no longer than nasal or nuchal cirri, and no more than $^{1}/_{2}$ diameter of eye in length. Dorsal scarcely, if at all, notched	2. *Rhabdoblennius jugularis* p. 349.
B. Nuchal cirri absent. Supraorbital cirrus as long as diameter of eye, or slightly longer. Dorsal scarcely, if at all, notched	3. *Rhabdoblennius snowi* p. 350.

1. **Rhabdoblennius cornifer** (Rüppell)

Blennius cornifer Rüppell, Atlas zu Reise Nord Afrika, Fische, 1828, p. 112.
Blennius cornifer Rüppell, Neue Wirbelt. aus Abyss., 1835, p. 135.
Blennius corniger Cuvier and Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 314.
Blennius cornifer Günther, Cat. Fish. Brit. Mus. III, 1861, p. 214.
Blennius cornifer Klunzinger, Verh. zool.-bot. Gesel. Wien XXI, 1871, p. 493.

D. XII. 19-20. A. II. 21. P. 14. V. I-3.

No crest on head. Nasal cirrus simple, shorter than pupil diameter. Supraorbital cirrus as long as eye, generally longer than, and often twice as long as, eye; slender and simple, or somewhat split at the end. Nuchal cirrus simple, about $^{1}/_{2}$ pupil in length. Forehead and mouth prominent; anterior profile somewhat concave. A small canine on either side below. Both parts of dorsal equal in height, the last spine short, leaving fin notched. Caudal rounded, free from soft dorsal. Colour olive or yellowish. Head and pectoral base with numerous white dots and lines. Vertical dark body bands distinct, often divided below. Four or 5 longitudinal rows of short blue-white bars on side of body. Dorsal with dark spot between first two spines; spinous dorsal with white spots and brownish mottlings; soft dorsal with black dots and a red border. Anal with blue-white dots on rays, and rays white tipped. Caudal green with white spots and posterior margin red. Pectorals and ventrals light.

Habitat: Waigeu! — Red Sea.

Note. The colour notes in the above description are taken chiefly from Rüppell and Klunzinger. A single specimen 26 mm. long collected by de Beaufort at Saonek, Waigeu, Dec. 1909 was found in the Amsterdam Museum. It apparently belongs to this species. The supraorbital cirri are $^1/_3$ longer than the eye, rod-like, and look like antelope horns; nuchal cirri, about $^1/_2$ the length of the pupil, are present. D. XII. 19. A. II. 21. The coloration, however, is almost completely absent (or perhaps had not yet developed). There is a dark spot between the first 2 dorsal spines continued back faintly on the anterior part of spinous dorsal as a dusky band. Unpaired vertical body bands are faintly evident. No other markings are noticeable on this specimen.

2. **Rhabdoblennius jugularis** (Klunzinger)

Blennius jugularis Klunzinger, Verh. zool.-bot. Gesel. Wien XXI, 1871, p. 493.
Salarias spec. M. Weber, Siboga Exped. Fische, 1913, p. 537.

D. XII. 18-19. A. II. 20-21. P. 13-14. V. 1-3.

No crest on head. Nasal, supraorbital, and nuchal cirri all simple, slender, and about the same length (about $^1/_2$ diameter of pupil), forehead prominent. No canines posteriorly on dentary. Depth 6.9. Head 4.3. Both parts of dorsal of equal height, scarcely emarginate, the last spine $^2/_3$ the height of the one preceeding it. Last anal ray nearly completely bound to caudal peduncle. Head evenly dusky with a pale spot about the size of the eye on lower cheek; cirri silvery. A dark symphyseal spot on throat followed by a narrow light band, then a broad, dark crescent between corners of mouth, a straight narrow light band behind this followed by a narrow, straight, dark band, a wider light band, and the edge of the branchiostegal membrane dark. A bright, silvery, vertically-oblong silvery spot on lower part of pectoral base reaching nearly to base of ventrals; base above this pale but not silvery, the two areas separated by an oblique, dark band. Six vertical dark body bands plus a saddle on caudal peduncle, the bands prominent at dorsal edge of body, then as large round spots on the middle of the side; not forked ventrally. Vertical body bands outlined by zig-zag series of blue spots or horizontally-oblong, short bars (silvery centered in life?), which are arranged as two or three irregular horizontal lines on sides. Spinous and soft dorsal similar: A large dark spot basally and two smaller ones distally on each spine and ray. The basal spots are the paired dorsal ends of the vertical body bands;

the smaller dots are partially joined by oblique dusky bands across the fin membrane. A distinct black spot on upper part of membrane between first two dorsal spines. Caudal crossed by 3 distinct dark bands narrower than pale interspaces; no white dots on fin. Anal pale basally, a prominent, dark, submarginal line; tips of rays white. Pectorals and ventrals pale and unmarked.

Habitat: Tau! — Red Sea.

Note. The above description is drawn from a female 32 mm. long taken at Siboga Station 149 (Insel Fau bei Gebe), in the Amsterdam Museum. It agrees in all respects with Klunzinger's description of *B. jugularis* from the Red Sea. The species is closely related to *R. fowleri* from the Philippines (which has a canine on the dentary, white spots but no dark bands across the caudal, and a few other colour differences), and *R. nativitatis* from Christmas Island (which has D. XII, 15; A. II. 17-18, and several colour pattern differences).

3. **Rhabdoblennius snowi** (Fowler)

?*Salarias nitidus* von Martens, Preuss. Exp. Ost-Asien. Zool. Theil I, 1876, p. 393.
Blennius snowi Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 431.
Salarias walaensis Herre, Journ. Pan-Pacific Res. Inst. VI, 1931, p. 14.
Salarias walensis Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII (12), 1935, p. 437.
Salarias walensis Herre, ibid. XXI, 1396, p. 413.
Blennius snowi Schultz, Bull. U. S. Nat. Mus. CLXXX, 1943, p. 270.
Rhabdoblennius snowi Norman, Ann. and Mag. Nat. Hist. (11) X, 1943, p. 809.

D. XII. 17-19. A. II. 20-21. P. 14. V. I-3.

No crest on head in either sex. Nasal cirrus simple, slender, pointed and about $^1/_2$ diameter of pupil in length. Supraorbital cirrus simple, slender, pointed and a little longer than diameter of eye (large specimens occasionally have one or the other of the supraorbital cirri bifurcate at tip). Nuchal cirri absent. Anterior outline approximately vertical, with forehead prominent; usually the snout and lips projecting a little beyond level of forehead leaving a concavity below eyes. A single long, slender canine on either side below located a little behind and interior to labial teeth. Labial teeth about 45 above, about 30 below, close set, long and slender, those in middle above the larger and about two-thirds size of canines. Depth 5.7 to 6.3. Head 4.4 to 4.7. Anterior dorsal spines same length as anterior rays, but posterior spines usually becoming a little shorter until last few spines only two-thirds of first ray, leaving somewhat of an emargination, but no notch. Membrane from last dorsal ray reaching over first two small rays of caudal. First anal spine of male two-thirds length of second; second more than one-half length of first ray; neither spines or rays modified as genital organs but tips of rays slightly swollen in both sexes. Membrane of last anal ray free from caudal, and outer third of ray free from membrane. Pectoral and caudal both equal to head in length. Middle rays of caudal a little shorter than outer rays, leaving fin a little crescentic when folded, but truncate when expanded. Third ray of pelvic always present, clearly visible, although slender and folded under larger second ray; tip free. *Male*: Top of head and nape tan. A lighter narrow band extending down edge of preopercle, over branchiostegals to throat. Snout, border of orbit and corner of mouth also light. Entire cheek dark brown. Middle of upper lip darker than snout; lower lip light; throat dusky anteriorly but lighter than cheeks posteriorly, without dark spots or markings. Some specimens have practically no dark pigment on head, body, or fins; others have vertical body bands, head and throat nearly black. A prominent dark oval spot on opercle nearly always present, but occasionally faded. A ring of five or six small round white spots around posterior border of eye always present, often joined by a row of spots across top of head. Always one or two white spots on maxillary, and sometimes four or five. A row of similar white spots running vertically across middle of cheek; a variable number of white spots, usually quite prominent, on opercle, upper and lower cheeks, ordinarily extending over branchiostegal membranes and occasionally meeting on midline of throat. Vertical dark bands of body usually quite evident but characteristically broken up into irregularly oblong vertical blotches, with a smaller blotch between each two larger ones. Bands particularly evident dorsally where they appear as eight dark blotches which reach half way up spiny dorsal and one-third up soft dorsal. Background between blotches light tan, not much lighter ventrally than dorsally. Anterior three-fourths of abdomen shows black from peritoneum, posterior quarter light (peritoneum black in smallest post larvae available). A dark band normally over opercle, sub-opercle, anterior half of pectoral base and across isthmus ahead of pelvics. Always several white spots on pectoral base and over basal one-third of fin. Numerous small white spots on body usually, but not always, extending down on abdomen, and particularly small and numerous on caudal third of body. Some of spots occasionally horizontally oblong but never longer than one-half diameter of pupil.

Outer half of spinous dorsal clear and unpigmented; lower half crossed by upper ends of body bands which are joined by reticulating dark lines which enclose light areas. A definite dark spot on upper part of membrane between first two dorsal spines. Soft dorsal clear except for extensions of body bands and faint streamers ascending obliquely from them. Anal light except for tips of first ten rays, which are quite dark. A small prominent triangular dark patch at base of middle caudal rays surrounded by light crescent. Lower third of caudal dark; dorso-anterior corner dusky; remainder unpigmented. Posterior half of pectoral base and fin light, without markings. Pelvics lightly pigmented except for outer two-thirds of first ray, which is conspicuously unpigmented. *Female*: No consistent difference noted between sexes in coloration. Females normally a little less melanistic, but males highly variable in this regard.

Habitat: East Indies Archip.! — Christmas Island (Indian Ocean)!; New Hebrides!; Phoenix Islands!; Caroline Islands.

Note. A single, male, 50 mm. long specimen of this species was found in the bottle containing the type series of *Salarias cyanostigma,* labeled simply: Col. Bleeker — Oost Ind. Archipel. (Leiden Museum 4749). The silvery spots remain distinct although the black markings are mostly faded. It fits precisely within the above description drawn from 107 specimens 25 to 62 mm. collected by Schultz at Enderbury Island. The species is closely related to *R. nitidus* from China and the Philippines, but can be distinguished by several colour pattern differences.

8. **Ecsenius** McCulloch

Ecsenius McCulloch, Rec. Austr. Mus. XIV, 1923, p. 121.
Ecsenius Norman, Ann. and Mag. Nat. Hist. (11) X, 1943, p. 810.

D. XII. 12-17. A. II. 13-20. P. 13-14. V. I. 2-3.

No crest on head in either sex. Nasal cirrus simple, bifid or trifid. No supraorbital or nuchal cirri. Both lips smooth. A small, hidden canine posteriorly on each dentary. 45-50 firmly placed teeth in lower jaw (typical of *Blennius*); more than 100 independently moveable comb-like teeth in upper jaw (typical of *Salarias*). No teeth on vomer. Depth 3.6 tot 6.0. Head 3.3 to 4.8. Lateral line a double series of pores anteriorly ending under eleventh dorsal spine and not turning downward on side. Dorsal notched or not, reaching to, or over, first small rays of caudal. A slender, projecting genital tube between anus and first anal spine in male, spines not bearing dendritic masses, anterior rays not especially elongate, last anal ray attached to caudal peduncle by membrane. None of caudal rays branched, one or more often elongated beyond membrane.

Habitat: Tropical Indo-Western Pacific from Red Sea to Marshall Islands and from Formosa to Northern Australia. About 6 species.

1. **Ecsenius frontalis** (C. and V.) (Fig. 50 p. 354)

Salarias frontalis Cuvier and Valenciennes, Hist. Nat. Poiss. XI, 1836, p. 328.
Salarias bicolor Day, Fishes of India, 4° Supplement, 1888, p. 798.
Salarias namiyei Jordan and Evermann, Proc. U. S. Nat. Mus., XXV, 1902, p. 362.
Salarias furcatus (not of De Vis, 1884) Johnstone, Rept. Ceylon Pearl Oyster Fish. II (suppl. 15), 1904, p. 213.
Salarias bicolor M. Weber, Siboga Exp. Fische, 1913, p. 533.
Salarias frontalis Bamber, Jour. Linn. Soc. XXXI, 1915, p. 484.
Salarias furcatus (not of De Vis, 1884) Whitley, Rec. Austral. Mus. XVII (3), 1929, p. 136.
Salarias burmanicus Hora and Mukerji, Rec. Ind. Mus. Calcutta XXXVIII, 1936, p. 34.

D. XII. 16-17. A. II. 18-20. P. 13-14. V. I. 3.

Nasal cirrus double. That on dorsal side of nasal pore simple, slender, pointed and equal to, or a little greater than, diameter of eye; that on ventral edge of pore usually simple, but occasionally forked or nearly double; and half length of dorsal cirrus. Anterior profile vertical or with forehead slightly projecting. A single, small canine close behind other teeth on dentary, hidden by a fold of membrane at corner of mouth in males, not found in females. Upper labial teeth more than 100, long, independently moveable and typically Salariin. Teeth on dentary 45-50, more than twice as stout as upper ones and shorter; only slightly moveable, as in *Rhabdoblennius*. Depth 5.0-5.2. Head 4.5-4.8. Dorsal spines all of approximately same length except for last, which is only $^2/_3$ height of next to last and half height of first ray. Soft dorsal highest in middle, the longest ray a little longer than longest spine. In small specimens the membrane comes down to level of last spine making a distinct, if shallow, notch; in larger specimens of both sexes, the membrane extends straight back, leaving no notch between parts of fin. Last rays of soft dorsal shortened and bound to caudal peduncle by membrane which reaches just to first small caudal rays. Both anal spines visible in both sexes, the first 1/2 length of first ray, the second 2/3 length of first ray. Females with a rounded, rather large genital papilla having a tiny nubbin on posterior edge. Males having a slender tube, half length of first spine, between anus and first anal spine. Each anal ray of male (but not of female, or spines of either sex) bearing a small, bulbous enlargement on anterior side of tip; anterior rays not elongate, a little shorter than dorsal rays; last ray membraneously bound to caudal peduncle. Membrane of dorsal and anal not excised, or only shallowly notched, between succeeding spines or rays. None of caudal rays branched, 6 small rays both above and below, and 13 principle rays. In large males the second and third principle rays above extend beyond edge of middle rays, the third to a distance half the length of middle rays; third principle ray from bottom extended from contour of fin to a distance 2/3 the length of middle rays. Middle rays of equal length so that fin is truncate except for elongated rays. In females of same size as above the elongated rays above and below project beyond fin edge by not more than 1/4 length of middle rays. In smaller specimens of both sexes they extend scarcely beyond normal edge of fin. Pectoral fin shorter than head by length of snout and 2/3 the eye. Ventral fin about 2/3 postorbital length of head; spine completely hidden; third ray slender, 2/3 length of second, so closely bound to it as to be visible only by dissection. Lateral line prominent and straight back to level of 10th dorsal spine, pores forming prominent cross marks; posterior to this point it extends only as a fine line, without noticeable pores, to end of soft dorsal. *Male*: Head and anterior 2/3 of body almost uniformly dark brown or reddish brown, peritoneum black. Dark area shading off posteriorly into a very pale area (bright yellow in life) which extends over caudal. Pale area extending anteriorly further along base of anal and soft dorsal. On smaller specimens dark pigment extends further posteriorly until it may reach caudal, but fish always lighter

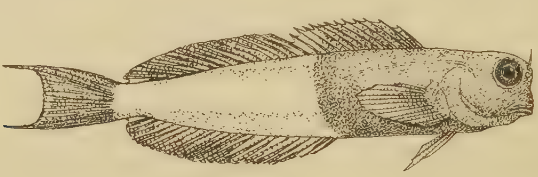

Fig. 50. *Ecsenius frontalis* (C. V.) × 1 1/2.

posteriorly than anteriorly. Except for an indistinct light band from eye down across upper lip and an indistinct dark streak directly behind orbit; there are no spots or markings on head or body. A continuous dusky band along basal portion of dorsal back to where light area of body begins. On spinous dorsal this covers the basal $^2/_3$ of fin and contains a horizontally elongated black streak over first 3 spines. Distal part of spinous dorsal clear except for margin; posteriorly this dark margin becomes broader until it melts into lower dusky band. Soft dorsal with a dusky marginal band but rest of fin clear except for basal pigment band anteriorly and a little pigment along each ray. In smaller specimens the dusky basal band extends to end of soft dorsal. Anal with a fine clear band mesially on anterior rays which broadens posteriorly to cover base and more than half of fin; remainder of fin, including entire distal edge, dusky except for fleshy pads on tips of rays, which are lighter. Caudal entirely pale. Pectoral rays dark, especially lower ones, but membrane clear and light. Ventrals dusky but lighter than body adjacent to them. Eyes and nasal cirri almost black. *Female*: Same as male except that light posterior part of body confined to a part of caudal peduncle, more of anal dusky, and some pigment on distal $^2/_3$ of middle of caudal. All of fins, in both sexes, because of slenderness of rays and spines and the translucency of the membranes, having a diaphanous quality not associated with *Salarias*.

Habitat: Eastern end of Timor! — Red Sea!; Aracan, India; Ceylon; Burma; Formosa; New Hebrides!

Note: Among the forms listed in the synonymy there is no more than sub-specific differences, if that much. The description is based on freshly collected material from the New Hebrides; Weber's specimen from Timor, in the Amsterdam Museum, differs in no essential detail from this.

9. **Petroscirtes** Rüppell

(Rüppell, Atlas Reise nördl. Afrika. Fische des rothen Meeres, 1828, p. 110)
Aspidontus Quoy & Gaimard, Voyage Astrolabe. Zoologie III, 1834, p. 719.
Blennechis Cuvier & Valenciennes, Hist. Nat. Poissons XI, 1836, p. 279.
Omobranchus Cuvier & Valenciennes, ibid. p. 287.
Enchelyurus Peters, Monatsber. Akad. Berlin. (1868) 1869, p. 268.
Dasson Jordan & Hubbs, Mem. Carnegie Mus. X, 1925, p. 318.
Meiacanthus Norman, Ann. Mag. Nat. Hist. (11) X, 1943, p. 805.

Elongate, compressed. No scales. Tentacles on head may be present. Mouth small, terminal, subterminal or inferior. Jaws with a single row of immovable teeth, and with lateral canines, those of the lower jaw much longer than those of the upper jaw. Gill membranes broadly united with isthmus and sides of body, leaving only a small gill opening, which is either totally above level of base of pectoral or prolonged lower down, seldom as far down as inferior end of pectoral base. Dorsal and anal long, the first beginning on head or shortly behind head, consisting of 24-25 rays, of which the posterior ones are generally articulated. Anal shorter than dorsal, with 15-32 rays. Both fins ending at some distance from caudal or broadly united with it. Caudal truncate, rounded, or somewhat pointed. Pectorals more or less rounded, the lower rays not thicker than the upper ones. Ventrals jugular, with two or three rays. Lateral line high up, incomplete. Pseudobranchiae present.

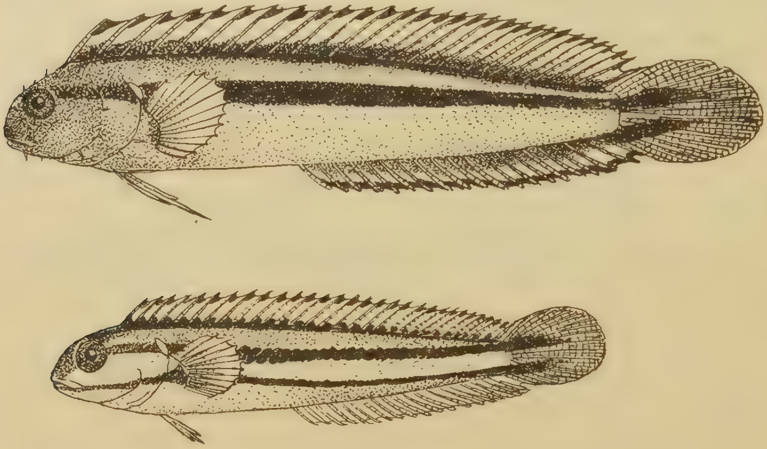

Fig. 51. *Petroscirtes grammistes* (C. V.) × 2. above: ♂. below: ♀.

Distribution. Tropical and subtropical parts of India and Pacific.

Note. Norman's paper on the genera of the family Blenniidae (Ann. Mag. Nat. Hist. (11) X, 1943, p. 793) came to my notice after I had finished the study of this genus. Norman has split up the old genus *Petroscirtes* in several other ones. I have used them as subgenera in the following key, which also was ready before I got Norman's paper, and which shows, that the way I grouped the species agrees fairly well with Norman's results.

Key to the Indo-Australian species of Petroscirtes

I. Anal and dorsal free from caudal.
A. Dorsal with 40-45 rays, its origin above hindborder of preopercle (*Aspidontus*).
a. Anal with 24, dorsal with 40 rays . . . . 1. *P. gorrorensis* p. 359.
b. Anal with 30-32, dorsal with 44-45 rays.
a^1. Two narrow white longitudinal bands.
a^2. One band along base of D., the other along base of A . . . . 2. *P. amblyrhynchus* p. 360.
b^2. One band touching upper border, the other lower border of eye . 3. *P. rhinorhynchus* p. 361.
b^1. A longitudinal row of dark blotches, separating dark upper parts from light underparts. Three narrow white lines on upper part of head. . . . . 4. *P. tapeinosoma* p. 362.
c. Anal with 28-30, dorsal with 40-41 rays. Dark above, light below, dark cross bands extending on dorsal . . . . . . 5. *P. fluctuans* p. 362.
B. Dorsal with less than 40 rays.
1. Origin of dorsal slightly behind eye. Gill opening a vertical slit, opposite to base of P. Mouth inferior. D. 37-38. A. 26-29 . . . . 6. *P. taeniatus* p. 363.
2. Origin of dorsal between eye and hindborder of preopercle. Gill opening a somewhat oblique slit, above base of pectoral .
a. D. 29-30. A. 17-20. Dark longitudinal bands (*Meiacanthus*).
a^1. Dorsal with 2 longitudinal dark bands . . . . . . 7. *P. grammistes* p. 364.
b^1. Dorsal with 3 longitudinal rows of dark spots . . 8. *P. solorensis* p. 366.
b. D. 25-26. A. 16-17. Five light, dark-edged ocelli along sides (*Petroscirtes* s. str.) . . . . . 9. *P. mitratus* p. 367.
3. Origin of dorsal above hindborder of preopercle. Gill

opening small, above base of pectoral.

a. Orbital tentacles present (*Dasson*).

- *a*¹. Height 3.8-3.9. D. 29-30. A. 18-20. Three dark longitudinal bands, the first along base of D, the second from eye to base of caudal . . . . . . 10. *P. polyodon* p. 368.
- *b*¹. Height 5-5.3. D. 28-31. A. 17-22. A broad dark band from eye to caudal. A black or dusky bar across caudal base. D. rays with diagonal rows of black spots . . . . . 11. *P. variabilis* p. 369.
- *c*¹. Height 4.5-5.5. D. 27-31. A. 17-20. Five broad vertical brownish bands, not always distinct . . . . 12. *P. eretes* p. 370.
- *d*¹. Height 4.1-5.4. D. 28-29. A. 19-20. Faint dark and light spots, traces of transverse bands, continued on dorsal and anal. 13. *P. bankanensis* p. 371.

b. Orbital tentacles absent. D. 31. A. 15. Three dark longitudinal bands. Caudal spotted . . . . 14. *P. temmincki* p. 372.

4. Origin of dorsal between hind-border of preopercle and gill opening, which is vertical, and opposite to base of P. Dark transverse bands (*Omobranchus*).

a. D. 30-31. A. 20-23. Transverse bands on body angulate, the angles pointing forward, and the band thickest here. An elongate, black, white-edged ocellus on middle of posterior section of dorsal . . . . 15. *P. kallosoma* p. 373.

b. D. 27. A. 18. Transverse bands brown, straight, bordered in front and behind with narrow darker stripes. No ocellus on dorsal . . . 16. *P. heyligersi* p. 374.

5. Origin of dorsal slightly before gill opening, which is small, and above base of pecto-

ral. Lower part of head with dark transverse bands (*Omobranchus*).

a. No lateral line. A dark blotch behind eye

a'. D. XII. 22. A. II. 24 . 17. *P. kranjiensis* p. 375.

b'. D. XII. 18. A. 21. . . . 18. *P. zebra* p. 376.

b. Lateral line present. A dark blotch on nape . . . . . 19. *P. kochi* p. 376.

II. Anal and dorsal broadly connected with caudal (*Enchelyurus*).

1. Gill opening wide, extending from above to below base of pectoral. D. 31-32. A. 22 . . . . 20. *P. flavipes* p. 377.

2. Gill opening narrow, beginning above level of base of pectoral, and ending opposite its fourth superior part. D. 29. A. 19 . . . 21. *P. kraussi* p. 378.

1. **Petroscirtes gorrorensis** Herre

Petroscirtes gorrorensis Herre, Philip. Journ. Sc. LIX, 1936, p. 285.

D. 40. A. 24. P. 14.

Height 7.2-7.3. Head 4-4.1. Snout, interorbital space, and eye approximately equal, 3.8-3.9 in head. The curved mouth is of moderate size, not reaching the eye. There are 10-12 teeth on each side of the upper jaw, with a small posterior canine. The large curved canine of the lower jaw equals the pupil. The elongate slender body tapers gradually from above the pectoral origin to the caudal base. The least depth of the caudal peduncle is 3.66-3.4 in the head. The head is elongate, conical, pointed, without tentacles or barbels, the gently curved snout projecting slightly beyond the mouth. The low dorsal begins above the posterior margin of the preopercle, and is highest in the posterior half, its height 2.4-2.5 in the head. The anal is a little lower, 3-3.16 in head. The bluntly rounded pectoral is 1.9-2, the ventral 2.7 in head. Colour in alcohol brown with a white stripe (blue in life) from eye to pectoral base and continued onto the base of the caudal. At right angles to the white stripe are ten white vertical bars, the first behind the pectoral, the last at the posterior end of the dorsal. These bars extend from the top of the dorsal to the longitudinal stripe and on below it a slight distance but diagonally backward. The dorsal has a white marginal line and a narrow white submarginal stripe. The anal is dark brown on the outer half, much paler basally. The caudal and pectorals are colourless, the ventrals colourless or faintly brown. Length 44 mm. (After Herre, not seen by me).

Habitat: New Guinea (Madang). — Pelew Islands.

2. **Petroscirtes amblyrhynchus** Blkr (Fig. 52, p. 360)

Petroskirtes amblyrhynchus Bleeker, Acta Soc. Sc. Indo-Neerl. II, 1857, Achtste bijdr. Vischf. Amboina, p. 64.
Petroscirtes amblyrhynchus M. Weber, Siboga Exp. Fische, 1913, p. 540.
Petroscirtes amblyrhynchus Herre, Philip. Journ. Sc. LXX, 1939, p. 329.

D. 44. A. 31-32. P. 12. V. 3.

Height 5.3-6.2, 6.4-7.3 in length with caudal. Head 4.1-4.2, 5 in length with caudal. Eye 3.5-3.6, 1.25-1.5 in flat interorbital space. Snout rounded, 1.2-1.3 in eye. A very long curved canine posteriorly in each side of the lower jaw. No canines in the upper jaw. Gill opening a vertical slit, about three fourths of eye, its lower end opposite the middle of the base of the pectoral. Head without tentacles. Origin of dorsal above hindborder of preopercle. Anterior dorsal rays about equal to interorbital space, following rays slightly decreasing in length to about the tenth, then increasing somewhat in height again. Anterior anal rays about as long as anterior dorsal rays, following rays slightly decreasing in length to the last. Pectorals as long as postorbital part of head and half eye. Ventrals as long as eye. Caudal forked. Traces of a straight lateral line, starting near upper end of base of pectoral and ending posteriorly at level of tip of pectoral. Colour of preserved specimens brownish with two faint longitudinal lines from snout, the upper one along base of dorsal, the lower one along base of anal, to base of caudal. A similar median band from origin of dorsal to interorbital space. Dorsal and anal hyaline, the former with 7, the other with 5 brown transverse bars, those of the anal corresponding to those of the

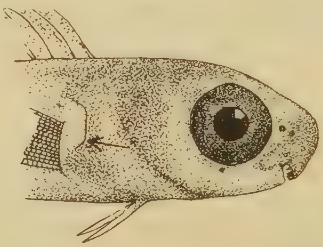

Fig. 52. *Petroscirtes amblyrhynchus* Blkr. × 4.

dorsal and sometimes faintly connected by a darker cross band on tail. Caudal and pectorals hyaline, ventrals speckled with brown. Length 43 mm.

Habitat: Saleyer!; Lembeh Strait; Celebes (Kema); Ternate; Ambon; Banda!; New Guinea (Manokwari). — Philippines. In sea.

3. **Petroscirtes rhinorhynchus** Blkr

Petroskirtes rhinorhynchos Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 273.
Petroscirtes rhinorhynchus Günther, Fische der Südsee II, 1876, p. 195.
Petroscirtes rhinorhynchus M. Weber, Siboga Exp. Fische, 1913, p. 540.
Petroscirtes rhinorhynchus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 840.
Petroscirtes rhinorhynchos Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 430.
Petroscirtes rhinorhynchus Herre, Philip. Journ. Sc. LXX, 1939, p. 328.

D. 44. A. 32. P. 12. V. 3.

Height 6.5-6.9, 7.5-8.3 in length with caudal. Head 4.3-4.7, 5-5.7 in length with caudal. Eye 3.6-3.8, 1.2 in snout. Interorbital space flat, four fifths of eye. Snout rounded. Mouth inferior. A very long curved canine posteriorly in each side of the lower jaw. No canines in the upper jaw. Gill opening a vertical slit, three fifths of eye, its lower end opposite to the middle of the base of the pectoral. Head without tentacles. Origin of dorsal above hindborder of preopercle. Anterior third of dorsal slightly lower than following part, the longest rays of which equal postorbital part of head in length, the posterior rays gradually diminishing in size, the last ray, which is implanted at a short distance from base of caudal, as long as eye. Median rays of anal longest, equal to postorbital part of head. End of anal opposite end of dorsal. Pectorals as long as postorbital part of head and half eye, ventrals equal to snout and half eye. Caudal forked. Lateral line inconspicuous. Colour of preserved specimens brown, with two parallel white narrow bands from snout, one touching upper border, the other lower border of eye, to base of caudal, the lower one interrupted at base of pectoral. The interspace between these lines darker on tail and still darker on caudal peduncle. Fins clear yellowish. Length 75 mm.

Habitat: Karkaralong Islands!; Sulu Islands; Celebes (Menado); Buru; Ceram; Ambon!; Haruko; Goram; Misol; Waigeu; New Guinea (Madang). — Coast of Natal, Philippines, Pelew Islands, New Hebrides, Kermadec Islands? In sea, on rocky coasts and off the coast on sandy bottom.

4. **Petroscirtes tapeinosoma** Blkr

Petroskirtes tapeinosoma Bleeker, Acta Soc. Sc. Indo-Neerl. II, 1857, Achtste bijdr. kennis vischf. Amboina, p. 64.
Petrocsirtes tapeinosoma Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 495.
Petroscirtes tapeinosoma Günther, Fische der Südsee II, 1876, p. 195.
Petroscirtes tapeinosoma Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 432.
Petroscirtes tapeinosoma Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 430.
Petroscirtes tapeinosoma J. L. B. Smith, Rec. Alb. Mus. IV, 1935, p. 213.
Petroscirtes tapeinosoma Fowler, Monogr. Ac. Nat. Sc. Philadelphia II, 1938, p. 207.

D. 45. A. 30. P. 12. V. 3.

Height 6.8, 7.9 in length with caudal. Head 5.3, 6.2 in length with caudal. Eye 3.2, more than snout and than flat interorbital space. Mouth inferior, reaching almost to below middle of eye. A pair of moderate canines in the lower jaw, none in the upper jaw. Gill opening a more or less vertical, somewhat curved slit, the lower end of which at level with lower part of base of pectoral, the upper end above level of pectoral base. Head without tentacles. Origin of dorsal above hindborder of preopercle. Dorsal low, the longest rays less than postorbital part of head. Anal still lower. Pectorals as long as postorbital part of head, the filiform ventrals one eye-diameter longer. Caudal slightly emarginate. Colour of preserved specimens blackish grey above, silvery below. A series of oblong black patches along sides. A narrow longitudinal silvery stripe along base of dorsal, meeting or almost meeting that of the other side on upper part of snout, and here enclosing a similar median stripe running to origin of dorsal. Dorsal and anal with black terminal bands. Caudal with a narrow median longitudinal band, reaching to the end of the fin. Length 80 mm. (Specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Celebes (Menado); Ambon!; Ceram!; Banda! — East Coast of Africa, Red Sea, Christmas Island, Carolines, New Hebrides, Samoa, Society Islands, Marquesas Islands. In sea.

5. **Petroscirtes fluctuans** M. Weber

Petroscirtes fluctuans M. Weber, Notes Leyden Mus. XXXI, 1909, p. 146. — Siboga Exp. Fische, 1913, p. 541.

D. 40-41. A. 28-30. P. 13-14. V. 2-3.

Height 3.3-3.6, 3.7-4.3 in length with caudal. Head 3.9-4.1, 4.6-5 in length with caudal. Eye 3.3-4, equal to snout and to flat interorbital space. Mouth subterminal. One or two small canines in the upper jaw and a very strong, much curved one in the lower jaw. Gill opening as long as eye, vertical, the lower end opposite middle of base of pectoral, the upper half higher up than base of pectoral. Origin of dorsal above hindborder of preopercle. Rays of posterior part of dorsal slightly longer than anterior ones, and equal to postorbital part of head. Anal less deep than dorsal, the rays increasing in size posteriorly, the longest as long as anterior dorsal rays. Posterior membranes of dorsal and anal reaching base of caudal. Pectorals longer than ventrals, and somewhat less or more than postorbital part of head. Caudal slightly rounded. Colour of preserved specimens brown above, light below, the two colours sharply separated by a dark brown longitudinal band, the upper margin of which is generally not very distinct. The dark upper parts crossed by about 8 transverse bands. Dorsal and anal brownish with indistinct cloudy darker patches, and with or without a white terminal and a brown subterminal longitudinal band. Ventrals yellowish. Pectorals and caudal yellowish hyaline. Length 45 mm.

Habitat: Celebes (Badjoa!); Makassar Strait; North of Flores; between the islands of Gébé and Fau!; Banda Sea!; off Faam, Kei Island! In sea, pelagic, often among floating algae.

6. **Petroscirtes taeniatus** (Q. G.)

Aspidontus taeniatus Quoy & Gaimard, Voyage Astrolabe. Zoologie III, 1834, p. 719.

Blennechis filamentosus Cuvier & Valenciennes, Hist. Nat. Poissons XI, 1836, p. 280.

Petroskirtes paradiseus Bleeker, Nat. Tijdschr. Ned. Indië VI, 1854, p. 495.

Petroskirtes rostratus Bleeker, Acta Soc. Sc. Indo-Neerl. II, 1857, Achtste bijdr. Vischf. Amboina, p. 62.

Petroscirtes filamentosus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 495.

Petroscirtes taeniatus Günther, Fische der Südsee II, 1876, p. 195.

Petroscirtes filamentosus Günther, ibid. p. 196.

Aspidontus taeniatus M. Weber, Siboga Exp. Fische, 1913, p. 544.

Aspidontus taeniatus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 842.

Petroscirtes filamentosus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 428.

Petroscirtes taeniatus Fowler, ibid. p. 429.

Petroscirtes taeniatus Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 402. —Philip. Journ. Sc. LIX, 1936, p. 372. — ibid. LXX, 1939, p. 328.

Petroscirtes filamentosus Herre, Philip. Journ. Sc. LXX, 1939, p. 329. — Rec. Indian Mus. XLI, 1939, p. 355.

D. 37-38. A. 21-29. P. 14. V. 3.

Height 5.4-5.9, 6.2-6.7 in length with caudal. Head 3.6-3.9, 4.2-4.5 in length with caudal. Eye 4.2-4.3, 1.3 in snout and equal to almost flat interorbital space. Mouth inferior. A strong much curved canine in each side of the lower jaw, a very small canine in each side of upper jaw. Gill opening a vertical slit, longer than eye, opposite base of pectoral. Origin of dorsal in a vertical slightly behind eye. Anterior dorsal rays slightly or much produced, in the last case (males?) they may be as long as the head. Posterior rays subequal, about as long as postorbital part of head. Anal as deep as dorsal. Posterior membranes of dorsal and anal reaching base of caudal. Ventrals with the outer ray produced as long as pectorals and as postorbital part of head and half eye. Caudal truncate. Lateral line close to base of dorsal, ending about below 10th ray. Colour of preserved specimens brownish, lower side lighter, and somewhat silvery. A dark band through eye to caudal, widening posteriorly, and continued on caudal, leaving only a small space of the fin above and below uncovered. Dorsal and anal dark brown. A more or less distinct brown band before base of pectoral. Ventrals with a brownish streak. Length 125 mm.

Habitat: Sumatra (West Coast of Atcheen!); North Coast of Celebes; Sulu Islands; Ambon; Goram; Banda!; New Guinea (Humboldt Bay). — Natal and Zululand Coast, Red Sea, Andamans, Philippines, Marianas, Carolines, Fiji, Samoa, Tonga, Society Islands, Paumotu Islands, Hawaii.

In sea. This fish swims with a peculiar undulating and twisting motion, that is very characteristic, swaying from side to side as it glides swiftly along. Very often it maintains its position beneath some much larger fish living on the reef. Like a shadow, the slender gleaming blue blenny twists and turns with every movement of the larger fish, always keeping the same relative position (Herre).

Note. The fish shortly described by Fowler (Mon. Ac. Nat. Sc. Philadelphia II, 1938, p. 207) as *Petroscirtes filamentosus* is probably not this species as it misses the dark lateral band and the dorsal and anal have a series of dark blotches.

7. **Petroscirtes grammistes** (C. V.) (Fig. 51, p. 356)

Blennechis grammistes Cuvier & Valenciennes, Hist. Nat. Poissons XI, 1836, p. 284.

Petroskirtes anema Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 273.

Petroscirtes anema Günther, Cat. Brit. Mus. III, 1861, p. 236. — Fische der Südsee II, 1876, Plate CXV, Fig. F.

Petroscirtes grammistes Günther, ibid. 1876, p. 197.

Petroscirtes lineatus De Vis, Proc. Linn. Soc. New S. Wales IX, 1884, p. 698.

Petroscirtes variabilis M. Weber, Jenaische Denkschr. VIII, 1895, p. 108 (nec Cantor).

Petroscirtes grammistes de Beaufort, Bijdr. Dierk. Afl. XIX, 1913, p. 149.

Petroscirtes grammistes Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 429.

Petroscirtes grammistes Whitley, Rec. Austr. Mus. XVI, N° 4, 1928, p. 229.

Petroscirtes kulambangrae Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII, N° 12, 1935, p. 436.

Petroscirtes kulambangrae Herre, ibid. XXI, 1936, p. 400.

Petroscirtes grammistes Herre, Philip. Journ. Sc. LXX, 1939, p. 335.

D. 29-30. A. 17-19. P. 14. V. 3.

Height 4.9-5.6, 5.7-6.9 in length with caudal. Head 3.9-5.2, 4.6-6.3 in length with caudal. Eye 3.2-3.4. Snout equal to or five sixths of eye. Interorbital space flat or slightly convex, one half to two thirds of eye or equal to eye in large specimens. Snout short, rounded. Mouth terminal. A strong somewhat curved canine in each side of the lower jaw, and a small one on each side of the upper jaw. Gill opening an oblique slit, shorter than eye, the lower end above the base of the pectoral. Females without tentacles. Males with a pair of tentacles on chin, and often two pairs on nape, several on interorbital space and on sides of head. Origin of dorsal in vertical midway between hindborder of eye and hindborder of preopercle. Dorsal rays subequal, equal to postorbital part of head, excepting the anterior and posterior ones, which are slightly shorter. Longest anal rays slightly shorter than longest dorsal ones. End of dorsal opposite end of anal. Pectorals equal to postorbital part of head or somewhat longer. Ventrals equal to snout and eye in females, in males the middle ray is produced and may be as long as the head. Caudal truncate or slightly rounded. Lateral line represented by a few pores high up above pectorals, near base of dorsal, Colour of preserved specimens creamy. In females three longitudinal black bands, the upper one along, and partly on, base of dorsal. The second one from upper lip, through eye, through gill opening to upper part of base of caudal and continued, tapering into a point, on proximal half of that fin. Third band from lower lip, below eye, through base of pectoral, to lower part of base of caudal and continued on caudal in the same way as the second band. Chin generally with a more or less diamond-shaped blackish marking. Besides the basal dark band already mentioned the dorsal has a blackish subterminal longitudinal band. Pectorals and ventrals creamy. In males the head is dark, the third band diffuse and only distinct on base of pectoral, on caudal peduncle, and on caudal. The subterminal band on the dorsal is jet black between the first and second rays, dusky and spreading downwards to the basal band between the following rays to about the seventh, and for the rest of the fin as in the female. Lower sides of head uniform dark, without markings. Anal with a dusky basal, and a black subterminal longitudinal band. Length. 74 mm.

Habitat: Singapore; Java; Buru; Ceram!; Ambon!; Batjan; New Guinea (Manokwari). — Coasts of China, Philippines, Yap, Solomon Islands, Murray Island in Torres Straits, Coast of Queensland.

In sea and brackish water, entering rivers.

Note. The sexual differences mentioned above are based on the material described by me l.c. 1913, when only two males and two females were dissected. Dissection of a few males and females now confirmed my previous opinion, but verification on more material is desirable.

8. **Petroscirtes solorensis** Blkr

Petroskirtes solorensis Bleeker, Nat. Tijdschr. Ned. Indië V, 1853, p. 81.
Petroscirtes solorensis Herre, Philip. Journ. Sc. LXX, 1939, p. 336.

D. 30. A. 20. P. 14. V. 3.

Height 5.33. Head 4. Snout convex, equal to eye, 3.4. Interorbital space 3.8 in head. Mouth almost terminal, reaching to below anterior part of eye. Canines in upper jaw very small, well developed in lower jaw. Gill opening rounded, its length less than that of eye. No tentacles on head. Origin of dorsal slightly before gill opening. Pectorals 6, ventrals about 8 in length. Caudal rounded. Violaceous brown, belly yellow. Two longitudinal diffuse blue bands, the upper one often interrupted, and composed of a row of spots. Fins yellow, vertical fins, especially the dorsal and anal, variegated with brown. Herre l.c. describes the colour as follows: "A violaceous-brown band passing over eye to middle of caudal and out for a third of its length; a yellowish-white band from upper margin of eye to caudal and one from upper lip to caudal; a very dark violaceous-brown stripe along dorsal base to caudal and a brown band from chin to caudal base, the two lastnamed converging on caudal to central band; dorsal brown, with three rows of darker-brown spots; anal brown, more or less clouded". Length 75 mm. (Compiled, not seen by me).

Habitat: Solor; Sulu Islands. — Philippines.

Note. Bleeker's single specimen is lost. It does not occur in the catalogue of the sale of his collections, and it is not in the Leiden Museum. As Bleeker remarked, this species is near *grammistes*. The species described by Kner (Novara-Exp. I, 1865-1867, Fische, p. 196) is not this species, but another, belonging to the *Enchelyurus* section of the genus.

9. **Petroscirtes mitratus** Rüpp.

Petroscirtes mitratus Rüppell, Atlas Reise nördl. Afrika. Fische des rothen Meeres, 1828, p. 111.
Blennechis mitratus Cuvier & Valenciennes, Hist. Nat. Poissons XI, 1836, p. 293.
Petroskirtes mitratus Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 244.
Petroskirtes Thepassi Bleeker, ibid. IV, 1853, p. 136.
Petroskirtes hypselopterus Bleeker, ibid. VIII, 1855, p. 423.
Petroscirtes barbatus Peters, Monatsber. Akad. Berlin 1855, p. 440.
Petroscirtes mitratus Günther, Cat. Brit. Mus. III, 1861, p. 237.
Petroscirtes barbatus Günther, ibid. p. 238.
Petroscirtes thepassi Günther, l.c.
Petroscirtes longifilis Kner & Steindachner, Sitzber. Akad. Wien LIV, 1866, p. 367.
Petroscirtes mitratus Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 496.
Petroscirtes mitratus Günther, Fische der Südsee II, 1876, p. 198.
Petroskirtes marmoratus Bleeker, Poissons de Madagascar, 1878, p. 74.
Petroscirtes barbatus Sauvage, Poissons de Madagascar, 1891, p. 383.
Petroscirtes marmoratus Sauvage, ibid., p. 384.
Petroscirtes mitratus Steindachner, Abh. Senckenb. naturf. Ges. XXV, 1901, p. 433.
Petroscirtes longifilis Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 431.
Petroscirtes hypselopterus M. Weber, Siboga Exp. Fische, 1913, p. 539.
Petroscirtes mitratus Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 842.
Petroscirtes mitratus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 430.
Petroscirtes hypselopterus Whitley, Great Barrier Reef Exp. Sc. Reports IV, N° 9, Fishes, 1932, p. 298.
Petroscirtes barbatus Herre, Notes Fishes Zool. Mus. Stanford Univ. 1934, p. 98.
Petroscirtes mitratus Herre, Philip. Journ. Sc. LXX, 1939, p. 330. — Rec. Indian Mus. XLI, 1939, p. 355.

D. 25-26. A. 16-17. P. 13. V. 3.

Height 3.3-4.3, 4.4-5.2 in length with caudal. Head 3.3-3.5, 4.3-4.4 in length with caudal. Eye 2.5-3. Snout two thirds or three fourths of eye. Interorbital space concave, two thirds or four fifths of eye. A moderate canine in the lower jaw and a small one in the upper one. Gill opening an oblique slit, the lower end of which is above the base of the pectoral. A short, flattened, lobate or branched tentacle above each eye. A still smaller one on each side of the nape, another above opercle. A row of small tentacles along hindborder of preopercle; a pair of somewhat larger ones on chin; small ones on upper side of head, just behind and before eye, and on snout. Origin of dorsal slightly in advance of vertical through hindborder of preopercle. First, second, and third rays of dorsal longer than the others, equal to head without snout or somewhat longer; the membranes between these rays incised, that between the third and fourth rays often very much so, the fin therefore more or less notched. Following dorsal rays subequal and about as long as postorbital part of head. Anal as deep as posterior part of dorsal. Anal and dorsal ending opposite to each other close to base of caudal, which is slightly rounded. Pectorals rounded, equal to postorbital part of head and half eye. Ventrals slightly shorter. Lateral line beginning above gill opening, running upwards to below fourth ray and continued closely along base of dorsal to below the 20th ray. Colour of preserved specimens brown, with cloudy dark blotches or irregular transverse bands on body and tail and five light, dark edged ocelli along upper part of sides. Dorsal hyaline with dark cloudy markings, more or less arranged as transverse bands, the membranes between the anterior rays entirely dark. Anal with similar markings or with an indistinct darkish longitudinal band at its base. Ventral brownish. Pectorals and caudal hyaline, the rays dark. Length 75 mm.

Habitat: Paternoster Islands!; Sumbawa!; Banda; Ambon; Obi; Ternate. — East Coast of Africa, Madagascar, Zanzibar, Mauritius, Red Sea, Coasts of Arabian Sea, Andamans, Coast of Siam, Philippines, Coast of Queensland, Carolines, Samoa.

In sea, on rocks.

10. **Petroscirtes polyodon** (Blkr.)

Blennechis polyodon Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 254.
Petroscirtes polyodon Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 99. — Philip. Journ. Sc. LXX, 1939, p. 335.

D. 29-30. A. 18-20. P. 14. V. 3.

Height 3.8-3.9, 4.3-4.5 in length with caudal. Head 3.6-3.8, 4.3-4.5 in length with caudal. Eye 3.4-3.8, equal to snout, and to slightly concave interorbital space. Mouth terminal, reaching nearly to below middle of eye. Canines of lower jaw very long and strong, those of upper jaw well developed. A short flap-like tentacle above each eye. Gill opening small, oblique, entirely above level of pectoral base. Origin of dorsal slightly behind vertical through hindborder of preopercle. Median dorsal rays longest, equal to postorbital part of head and half eye. Anal lower than dorsal. Ventrals as long as postorbital part of head, pectorals half a diameter of eye longer. Caudal truncate. Colour of preserved specimens yellowish. A dark brown median longitudinal band along base of dorsal. A similar band through eye to base of caudal. Another from base of pectoral to base of caudal, sometimes indistinct in its anterior course. Dorsal with longitudinal rows of dark spots. Anal yellowish or freckled with dark brown. Base of pectoral dark brown. Caudal yellowish. Length 87 mm. (Typical specimens of Bleeker's collection in the Leiden Museum examined).

Habitat: Bay of Jacarta!; Celebes (Makassar); Ambon. — Philippines. In sea, sometimes found below floating algae.

11. **Petroscirtes variabilis** Cantor

Petroscirtes variabilis Cantor, Journ. Asiat. Soc. Bengal XVIII, 1850, p. 1182.
Petroscirtes cynodon Peters, Monatsber. Akad. Berlin, 1855, p. 439.
Petroscirtes variabilis Günther, Cat. Brit. Mus. III, 1861, p. 234.
Petroscirtes variabilis Day, Fishes of India, Part II, 1876, p. 327. — Suppl. 1888, p. 796.
Petroscirtes variabilis Macleay, Descr. Cat. Austral. Fish II, 1881, p. 6.
Petroscirtes variabilis Jatzow & Lenz, Abh. Senckenb. Ges. XXI, 1899, p. 513.
Petroscirtes variabilis Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 841.
Petroscirtes variabilis Herre, Philip. Journ. Sc. LXX, 1939, p. 334.
Petroscirtes variabilis Blegvad, Danish Sc. Inv. Iran, Part III, 1944, p. 178.

D. 28-31. A. 17-22. P. 13-15. V. 3-4.

Height 5-5.3, 5.6-6.2 in length with caudal. Head 3.7-3.8, 4.1-4.4 in length with caudal. Eye 3-3.3. Snout five sevenths of eye. Interorbital space six sevenths of eye. Mouth terminal, extending to vertical through front margin of pupil in large specimens. Lower canines strong. Upper canines very small. Gill opening a short crescent-shaped oblique fissure, just above and a little in front of the pectoral base. Two small tentacles on chin, not always present. A short simple orbital tentacle and a small one on nape, above gill opening. Origin of dorsal above or somewhat behind vertical through hindborder of preopercle. First dorsal ray a little shorter than the others, which are nearly equal, and as long as postorbital part of head; the last dorsal ray is connected by a triangular membrane to the posterior part of the caudal peduncle. The anal commences opposite the twelfth dorsal ray; it resembles the dorsal, but the rays are a little shorter. Pectorals equal to postorbital part of head and half diameter of eye, and slightly less than the ventrals, the middle ray of which is the longest and broader than the posterior one. Caudal slightly rounded. The lateral line proceeds from the posterior part of the opercle obliquely upwards to about the fifth dorsal ray, from whence it follows close to the base of the fin towards the eleventh ray, when it turns for a short distance obliquely downwards and suddenly terminates. Colour of preserved specimens reddish brown. A broad black or bluish black band extends from eye to caudal, with a black or dusky bar across caudal base. A row of indistinct light blotches along the lower side of this band. Dorsal and anal yellow, rays with diagonal rows of black spots. The base of the dorsal black. Caudal yellow, with or without transverse rows of dark spots. Length 125 mm.

Habitat: Singapore; Great Salembu!; Borneo (Sandakan). — Mozambique, Zanzibar, Red Sea?, Seychelles, Persian Gulf, Calicut, Nicobars, Penang, South Chinese Sea, Philippines, New South Wales. In sea. The specimens from Great Salembu were caught below a floating dead Nautilus.

Note. Day 1888 l.c. adds *P. petersi* Kossman & Räuber (Zool. Erg. Reise Küstengebiete Roth. Meeres, Pisces, 1877, p. 21) from the Red Sea with a query to the synonymy of *variabilis*. According to the description *petersi* has D. 34. A. 25, and the gill opening is rather large, extending downwards as far as the base of the pectoral. Probably it is a different species.

12. **Petroscires eretes** Jordan & Seale

Petroscirtes eretes Jordan & Seale, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 801. — Bull. Bur. Fish. XXVI (1906) 1907, p. 47.
Petroscirtes eretes Jordan & Richardson, ibid. XXVII (1907) 1908, p. 283.
Petroscirtes eretes Herre, Philip. Journ. Sc. LXX, 1939, p. 333.

D. 27-30. A. 2. 15-18.

Height 4.5-5.5. Head 3.85-4.2. Eye 3.5-3.75. Mouth subterminal, extending back beneath pupil. About 20 teeth on each side of upper jaw. A pair of large strong canines in lower jaw and a pair of much smaller ones above. Gill opening a short oblique somewhat curved fissure, just above and a little in front of pectoral. A pair of simple slender tentacles on throat, some distance from chin. A pair of minute simple tentacles on nape, a similar pair on upper margin of opercle. Lastnamed two pairs may be broad flaps, and either pair may lack one member. A small and rather broad simple tentacle at top of each eye. Origin of dorsal about above hindborder of preopercle. First dorsal ray a little shorter than the rest, which are nearly equal, and two thirds of the height of the body. Origin of anal about below 15th dorsal ray. Anal somewhat deeper than dorsal. Both fins connected by a triangular membrane to the end of the caudal peduncle. Pectorals and ventrals 1.5 in head. Caudal rounded. Lateral line running along base of dorsal, bent downwards about below 10th dorsal ray and ending about below 14th ray. Preserved specimens mottled brown, with whitish spots and dots which are blue in life. Five broad vertical brownish or dusky bands across sides of body, which are often indistinct or disappear in preservative. Dorsal barred by longitudinal rows of reddish brown spots on front half, and diagonally downward and backward rows on second half. Anal with 4 or 5 vertical or diagonal brown bands, and may be spotted as well. The yellow caudal may also be cross-barred with brown spots. Dorsal and anal both with outer margin yellow. A dusky bar through base of caudal may be present. Length 81 mm (Compiled, not seen by me).

Habitat: Singapore; Sulu Islands. — Philippines, Pelew Islands.

Note. This species may not be different from *variabilis,* as suggested by Jordan & Richardson l.c., the principal difference being the presence of a broad dark band from eye to caudal in *variabilis.* Traces of such a band may, however, be present in *eretes,* according to Jordan & Richardson. It is certainly also very close to *bankanensis.*

13. **Petroscirtes bankanensis** Blkr.

Petroskirtes bankanensis Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 727.
Petroskirtes amboinensis Bleeker, ibid. IV, 1853, p. 114.
Petroscirtes bankanensis Günther, Cat. Brit. Mus. III, 1861, p. 237.
Petroscirtes bankanensis M. Weber, Siboga Exp. Fische, 1913, p. 540.
Petroscirtes bankanensis Herre, Philip. Journ. Sc. LXX, 1939, p. 331. — Rec. Indian Mus. XLI, 1939, p. 355.

D. 28-29. A. 19-20. P. 14. V. 3.

Height 4.1-5.4, 5.3-6.2 in length with caudal. Head 3.2-3.7, 4-4.4 in length with caudal. Eye 3.6-4, equal to snout and to almost flat interorbital space. Mouth terminal. A rather strong, slightly curved canine on each side of the lower jaw and one or two small ones on each side of the upper jaw. According to Bleeker the canines in the lower jaw may be double too. Gill opening an oblique slit, the lower end of which is above the base of the pectoral. A short flattened more or less pear-shaped tentacle above eye, very short ones on snout and on nape, the latter may be absent. Origin of dorsal above hindborder of preopercle. Height of dorsal equal to or somewhat more than eye; dorsal rays subequal. Anal scarcely lower, both fins ending opposite to each other near base of caudal. Pectorals equal to postorbital part of head and half eye, ventrals as long as postorbital part of head. Caudal rounded. Lateral line close to base of dorsal, ending below 19th ray. Colour of preserved specimens reddish brown with faint lighter and darker spots, and with traces of dark cross bars, which are continued on dorsal and anal and form here a series of brown blotches on the light fin. Other fins yellowish hyaline. Length 120 mm.

Habitat: Singapore; Nias; Banka; Kangean Islands!; Sumbawa!; Rotti!; Ceram; Ambon. — Andamans, Philippines.
In sea. Neritic and litoral on sandy beaches and reefs.

14. **Petroscirtes temmincki** Blkr

Petroskirtes Temminckii Bleeker, Nat. Tijdschr. Ned. Indië II, 1851, p. 243.
Petroscirtes temmincki Herre, Philip. Journ. Sc. LXX, 1939, p. 337.

D. 31. A. 15. P. 15. V. 3.

Height 3.8-4.2, 4.7-5.2 in length with caudal. Head 3-4, 3.9-4.9 in length with caudal. Eye 3-3.3, about equal to snout and to almost flat interorbital space. No tentacles on head. Mouth terminal, nearly reaching to below middle of eye. Canines in lower jaw very strong, those of upper jaw well developed. Gill opening small, oblique, above level of base of pectoral. Origin of dorsal scarcely behind hindborder of preopercle. Height of dorsal less than postorbital part of head, ventrals somewhat shorter. Caudal truncate. Colour of preserved specimens whitish, with three dark brown longitudinal bands: a median one along base of dorsal, one from snout through eye to base of caudal, and the third from mouth along lower border of eye to base of caudal. The second and third bands are often broken into rows of spots on tail. Dorsal with one or more rows of dark spots or blotches, anal with one row of similar spots, caudal with more or less developed transverse rows of dark spots. Pectorals and ventrals hyaline. (Description made after specimens of Bleeker's collection in the Leiden Museum).

Habitat: Ternate; Ceram; Buru; Ambon; Haruku; Goram; Flores; Rotti; Banda. — Philippines.

15. **Petroscirtes kallosoma** Blkr

Petroskirtes kallosoma Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 227.
Petroscirtes kallosoma Borsieri, Ann. Mus. Civ. Genova (3) I, 1904, p. 210.
Petroscirtes kallosoma Herre, Philipp. Journ. Sc. LXX, 1939, p. 332. — Copeia 1942, n° 2, p. 115.

D. XII. 18-19. A. 20-23. P. 13-14. V. 2.

Height 5.5-6.1, 6.4-6.8 in length with caudal. Head 4.2-4.4, 4.9 in length with caudal. Eye 3.2-3.6. Snout short, four fifths or five sixths of eye. Interorbital space narrow, slightly concave, equal to half diameter of eye. Head without tentacles. Mouth subterminal. A long almost straight canine in the lower jaw. In my specimens, 32-35 cm long, I do not find canines in the upper jaw, but Bleeker, who examined a specimen of 60 mm, mentions them saying that the canines in the lower jaw are much longer than those of the upper jaw. Gill opening a vertical slit, almost equal to eye, the lower end opposite middle of base of pectoral. Origin of dorsal behind vertical through hindborder of preopercle and slightly before that through gill opening. The twelve anterior rays of the dorsal are not articulated and lower than the posterior ones, the longest of which equals postorbital part of head. Anal about as deep as anterior part of dorsal (female?) or almost as deep as posterior part (male?). Dorsal and anal ending opposite each other at a short distance from base of caudal. Pectorals as long as head without snout or almost as long as head. Ventrals equal to postorbital part of head. Caudal slightly rounded, the outer upper and lower rays may be produced into a short filament (male?). Colour of preserved specimens dark brown. Body and tail with distant angulated black transverse bars, the angles pointing forward and the band thickest here. A dark blotch on caudal peduncle. Fins uniform light brownish hyaline. In the male(?) the head is spotted or striped with dark on the sides and below; similar spots also above pectorals. An elongate black, white edged ocellus on middle of posterior section of dorsal. Length 60 mm.

Habitat: Biliton; Sumbawa!; Celebes (Kwandang!); Ambon; Timor. — Eritrea, Philippines.

Note. Weber has already mentioned that the Siboga specimens do not exactly agree with Bleeker's diagnosis. The specimen from Sumbawa however, 35 mm long, is in accordance with that described by Bleeker, having the outer rays of the caudal produced, an ocellus on the dorsal, and spots or stripes on the head and before the pectorals. It also agrees with the specimen Herre figured (l.c. Pl. 4). It only differs in the number of anal rays, which is 20 and not 23. The other specimen, 32 mm long, lacks the spots on the head, the ocellus on the dorsal, and the produced rays of the caudal. I presume that it is a female. Herre (l.c. 1942) also states that the dorsal ocellus is absent in females and young males. Fowler (Mem. B. P. Bishop Mus. X, 1928, p. 429) considers this species to be the same as *P. elongatus* Peters (Monatsber. Akad. Berlin 1855, p. 440), following Günther (Fische der Südsee II, 1876, p. 196) who mentions *kallosoma* with a query as a synonym of *elongatus*. I have not seen this species, but according to the description it lacks the vertical bands on the body and it also differs from *kallosoma* in having a dark, white edged ocellus on the opercle. Otherwise it seems to be very much like *kallosoma*, and it is possible that lastnamed species is only a colour variety.

16. **Petroscirtes heyligersi** Blkr.

Petroskirtes Heyligersi Bleeker, Nat. Tijdschr. Ned. Indië XVI, 1858-1859, p. 340.

D. 27. A. 18. P. 13. V. 3.

Height 6.1-6.8. Head 3.4, 3.8 in length with caudal. Eye 3.5, equal to snout. Interorbital space very narrow, less than one third of eye. No tentacles on head. Mouth terminal, ending below anterior part of eye. Moderate canines in lower jaw. Gill opening a large vertical slit, reaching from before lower part of base of pectoral to above pectoral base. Origin of dorsal between verticals through gill opening and hindborder of preopercle. Longest dorsal rays about equal to postorbital part of head. Anal lower. Ventrals as long as postorbital part of head, pectorals one half diameter of eye longer. Caudal truncate. Colour of preserved specimen brown. About

9 darker brown crossbars on body and tail, each bordered in front and behind by a narrower black band. Fins yellowish hyaline. Description made after the type of the species in the Leiden Museum, long 49 mm.

Habitat: Sumatra (River Musi at Palembang!). — Madagascar.

Note. Bleeker's specimens came from fresh water. This species has not been found again in the Indo-Australian Archipelago, but Jatzow & Lenz (Abh. Senckenb. Ges. XXI, 1899, p. 513) record it from the coastal zone ("Strandzone") of Madagascar.

17. **Petroscirtes kranjiensis** Herre

Petroscirtes kranjiensis Herre, Bull. Raffles Mus. N° 16, 1940, p. 25.

D. 34 (XII + 22). A. II. 24.

Height 5.33-5.5, caudal 5, head 4-4.16. Pectoral and ventral each 5 times in length. Eye 4-4.2, snout 4-4.3, postorbital 1.9, least depth of caudal peduncle 2.6-2.7 times in head, interorbital space 1.8 in eye. The slender, laterally compressed body is deepest at the dorsal origin, which is over the opercle, forward of the gill opening. The dorsal profile is convex from the nape to the tip of the snout, which is nearly vertical; the eye is far forward, flush with the profile; the mouth extends beneath the middle of the eye; the lower canines are moderately large, the upper canines at least half as large; the pectorals and ventrals do not extend to the vent; the dorsal is highest posteriorly 1.75 to 1.9 times in the head, the rays beyond the twenty-eighth shorter; the anal height is 3.2 to 3.5 in the head; no tentacles or dermal flaps. The colour in alcohol is grey, with 16 indistinct cross bands, most distinct along the dorsal base and a short distance below; there is a narrow blue-black bar behind the eye, and a dark spot on the pectoral base. The fins are densely sprinkled with minute brown specks; there are two dark spots, badly faded, at the caudal base; the smaller specimen has a black spot at the top of the three last dorsal rays. Length 42 mm (After Herre, not seen by me).

Habitat: Singapore, from a mangrove swamp drained by the Kranji river.

18. **Petroscirtes zebra** Blkr

Petroskirtes zebra Bleeker, Versl. Akad. Amsterdam (2) II, 1868, p. 279.
Hypleurochilus loxias Jordan & Seale, Proc. U. S. Nat. Mus. XXVIII, 1905, p. 802.
Petroscirtes loxias Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 98. — Philip. Journ. Sc. LXX, 1939, p. 332.

D. XII. 18. A. 21. P. 13. V. 2.

Height 5.7, 6.5 in length with caudal. Head 4.1, 4.7 in length with caudal. Eye 3.6, twice interorbital space. Mouth terminal, reaching to below anterior part of eye. A pair of long canines in the lower jaw, short ones in the upper jaw. No tentacles on head. Gill opening small, above level of base of pectoral. Origin of dorsal above gill opening. Longest dorsal rays equal to postorbital part of head. Anal lower than dorsal. Ventrals equal to postorbital part of head, pectorals more than half diameter of eye longer. Caudal slightly rounded. No lateral line. The type specimen which is described above, has now lost all colour, but according to Bleeker the head has 4 transverse vertical dark bands, the first on snout, the second and third through eye, the fourth on opercle. Body and tail with about 8 dark transverse bands, the first from nape to pectoral, and narrower than the others. Dorsal and anal freckled with brown. A brown blotch anteriorly on upper part of dorsal. Length 54 mm.

Habitat: Singapore!; Sulu Islands. — Philippines.

Note. *Hypleurochilus loxias* agrees in all principal points with *P. zebra,* and although the colouring is somewhat different, it may be considered as a synonym of *zebra*. Fowler (Notulae Naturae N° 3. 1939, p. 2) considers *Hypleurochilus loxias* as a synonym of *P. dispar* Günther (Cat. Brit. Mus. III. 1861, p. 232) from Amoy.

19. **Petroscirtes kochi** M. Weber

Petroscirtes Kochi M. Weber, Nova Guinea V, Livr. 2, 1908, p. 263.
Petroscirtes masyae H. Smith, Journ. Siam Soc. Nat. Hist. IX, N° 3, 1934, p. 316.

D. 31-32 (12 + (19-20)). A. (2) + 20-21. P. 12-13. V. 2.

Height 5.6-6.3, 6.3-7.3 in length with caudal. Head 4.5-4.6, 5.1-5.4 in length with caudal. Eye 3.7-4.7, about equal to snout. Interorbital space flat, three fourths or one half of eye. Head without tentacles. Mouth terminal. 26-28 teeth in the jaws. A large canine in the upper jaw and a much larger one in the lower jaw. Gill opening a short oblique slit entirely above base of pectoral. Origin of dorsal above gill opening. Twelve anterior dorsal rays not articulated, somewhat lower than posterior articulated rays, the longest of which equals postorbital part of head. Anal about as deep as anterior part of dorsal. Dorsal and anal attached by membranes to base of caudal, not to the fin proper. Pectorals as long as head or slightly shorter. Ventrals as long as postorbital part of head. Caudal rounded. Lateral line high up, ending below 10th dorsal ray. Colour of preserved specimens yellowish brown, with indications of about 9 cross bars below the dorsal which do not reach further down than the middle of the sides. A dark brown blotch slightly anterior to vertical connecting origin of dorsal and gill opening. Three dark cross bands on head, one from eye to eye over lower jaw, the second from eye to eye over isthmus, the third also over isthmus, running from opercle to opercle. These bands now very faint in the typical specimens. Base of pectoral with a dark transverse spot. Ventrals, pectorals, caudal and dorsal hyaline, last one with a faint longitudinal band along its middle. Anal darker, with a dusky terminal band. Length 51 mm.

Habitat: New Guinea (Merauke!). — Siam. In brackish water.

Note. This species is allied to *zebra,* differing in the presence of a lateral line and in the coloration, the large black blotch on nape being represented in *zebra* by a similar one behind eye.

20. **Petrosciries flavipes** (Peters)

Enchelyurus flavipes Peters, Monatsber. Akad. Berlin (1868) 1869, p. 268.
Enchelyurus flavipes var. *nigerrima* M. Weber, Siboga Exp. Fische, 1913, p. 545.
Enchelyurus flavipes Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 98.
Enchelyurus flavipes Herre & Meyers, Bull. Raffles Mus. N° 13, 1937, p. 47.
Enchelyurus flavipes Herre, Rec. Indian Mus. XLI, Part IV, 1939, p. 356. — Philip. Journ. Sc. LXX, 1939, p. 339.

D. 31-32. A. 22. P. 16. V. 2.

Height 4.1-4.4, 4.7-5.2 in length with caudal. Head 3.9, 4.5-4.6 in length with caudal. Eye 4.1-4.5, near convex anterior profile of head. Interorbital space slightly convex, five eighths or four sixths of eye. Mouth subterminal, its cleft reaching almost to below hind-border of eye. A strong curved canine in the lower jaw, and a shorter but well developed one in the upper jaw. Gill opening a wide vertical slit, extending from above to below base of pectoral. Origin of dorsal above hindborder of preopercle. Dorsal increasing in height posteriorly, the last ray equal to postorbital part of head and nearly twice as long as the first one. Membranes between the rays not incised. Anal similar to dorsal but lower, the first rays very short. The membranes between the rays incised. Both dorsal and anal broadly united to caudal which is bluntly pointed. Pectorals equal to head without snout or somewhat shorter. Ventrals longer than pectorals, filamentous, the filaments sometimes reaching anal. Lateral line consisting of distant tubes, high up along base of dorsal, ending about below the 12th dorsal ray. Colour of preserved specimens dark brown, including the fins, excepting the pectorals which may be lighter. Caudal also sometimes lighter. Anal with narrow lighter longitudinal bands. In one specimen the lower parts of the gill membranes and isthmus are lighter with oblique parallel darker brown bands. Length 76 mm.

Habitat: Singapore; Island Barang near Makassar! Celebes (Makassar). — Andamans, Philippines. In sea, on reefs.

21. **Petroscirtes kraussi** Klz.

Petroscirtes Kraussi Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 497.

D. 29. A. 19. P. 15. V. 2.

Height 4, 4.7 in length with caudal. Head 3.5, 4.1 in length with caudal. Eye 4, near anterior profile of head which is straight and almost vertical. Interorbital space somewhat concave, three fourths of eye. Mouth small, its corner scarcely reaching to below middle of eye. A short but strong canine in the lower jaw, and a somewhat smaller one in the upper jaw. Gill opening a vertical slit, shorter than eye, beginning above level of base of pectoral and ending opposite its superior fourth part. Origin of dorsal above hindborder of preopercle. Dorsal increasing in height posteriorly, the last ray equal to postorbital part of head and more than twice as long as the first one. Membranes between the rays not incised. Anal similar to dorsal but slightly lower, the membranes between the rays incised. Both dorsal and anal broadly united to caudal, which is rounded. Pectorals equal to postorbital part of head and half eye. Ventrals, the rays of which are slightly filamentous, equal to postorbital part of head. Lateral line, consisting of distant tubes, high up along base of dorsal, ending below the 9th dorsal ray. Colour of preserved specimen dark brown, underside of head, throat and belly somewhat lighter. Dorsal brown with narrow blackish oblique streaks. Anal brown with a faint lighter longitudinal band. Caudal and pectorals very light brownish hyaline. Ventrals light brown. Length 40 mm.

Habitat: Pulu Berhala in Malacca Straits! — Red Sea.

Note. The specimen described above from Pulu Berhala, 33 mm long, differs only in minor details from Klunzinger's description. The specimens from the Red Sea have one ray more in the dorsal and the anal. The height is given as 5.5, head 5, eye 3.5. The colour is described as black or blackish green, the posterior part of the body often lighter, more olive. Tips ot pectorals greenish yellow. Sides of head with parallel oblique, somewhat wavy black and blackish blue stripes, similar ones also through iris. Anal with a blue longitudinal stripe, the tips of the rays bluish white.

Petroscirtes spec. juv. (Fig. 53, p. 380)

(Max Weber, Siboga Exp. Fische, 1913, p. 543)

Max Weber figured l.c. a young fish which he supposes to be a larval Petroscirtes. The most striking features are the serrated ridges on both sides of the dorsal, and the armature of the head. The single specimen is 15 mm long and has been caught at night by electric light at the surface of the sea near Laiwui, Obi major.

10. **Lembeichthys** Herre

(Herre, Philip. Journ. Sc. LIX, 1936, p. 283)

Much elongate. Mouth inferior, rather large. A single row of incisor-like teeth in the upper jaw, and the end tooth on each side pointed, and a little larger than the others. A single row of teeth in the lower jaw, their tips shaped like arrowheads, and a large pair of posterior canines. Gill opening small, above upper angle of pectoral base. Dorsal and anal long, the first beginning on head, with 68-70 flexible spines. Anal beginning far forward. Caudal free, somewhat rounded. Pectorals pointed. Ventrals very small, composed of two rays, inserted beneath hind margin of opercle.

Distribution that of the single species known.

1. **Lembeichthys celebesensis** Herre

Lembeichthys celebesensis Herre, Philip. Journ. Sc. LIX, 1936, p. 283. — ibid. LXX, 1939, p. 366.

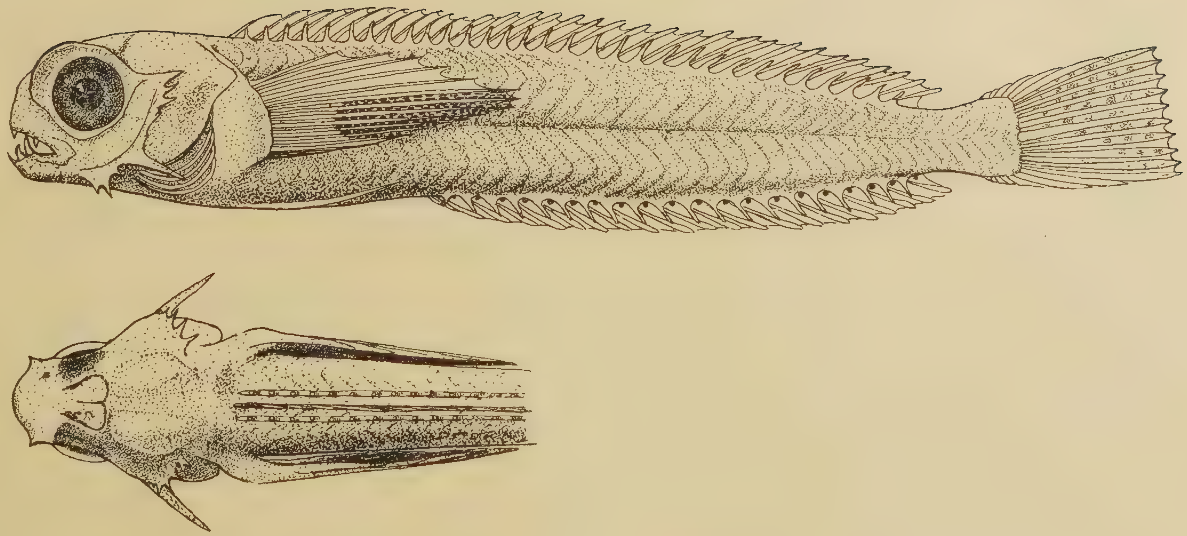

Fig. 53. *Petroscirtes* spec. juv. × 10.5

D. 68-70. A. 50-55. V. 2.

Height 15.7. Head 7.85-8.46. Head and trunk together 2.4-2.9 in tail. Eye 3.33-3.6. Snout blunt, projecting, 4.1-5.4 in head. Interorbital space equal to eye. Mouth extending beneath anterior portion of pupil. 20-22 teeth in the upper and 22 teeth in the lower jaw. First few dorsal spines low, those following highest, $2^1/_3$ in head, most of fin of nearly uniform height. Anal 3.5 in head. Alcohol specimens pale tan, lower half sprinkled with reddish brown specks, and with more or less silvery sheen on sides of head, trunk, tail, and yellow belly; five dark brown spots on dorsal region beneath dorsal, first above anal origin. Snout dusky, area between eyes and dorsal origin dark brown. Dorsal and anal pinkish brown, densely dotted with dark brown specks, and with a black margin. Caudal with a large red brown basal spot, rest of fin white. Pectorals and ventrals also white. Length 55 mm (After Herre, not seen by me).

Habitat: Lembeh Strait, Celebes. Probably a pelagic blenny, caught while fishing with electric light.

11. **Xiphasia** Swainson

(Swainson, Nat. Hist. Fishes II, 1839, p. 259)

Nemophis Kaup, Proc. Zool. Soc. London, Part XXVI, 1858, p. 168.
Xiphogadus Günther, Cat. Brit. Mus. IV, 1862, p. 374.

Very elongate, eel-like, compressed. Mouth small, terminal. Jaws with a single row of immovable slender teeth and lateral canines, those of the lower jaw much longer than those of the upper jaw. Gill membranes broadly united with isthmus, leaving only a small gill opening. Dorsal and anal very long, the first beginning on head, and with more than 100 rays. Anal beginning far forward, with about 100 rays. Both fins broadly united to caudal, the median rays of which may be prolonged and filamentous. Pectorals more or less rounded, the lower rays not thicker than the upper ones. Ventrals jugular, consisting of three rays. Lateral line along upper half of sides of body, disappearing on tail.

Distribution: See that of single species known.

1. **Xiphasia setifer** Swainson (Fig. 54, p. 382)

Xiphasia setifer Swainson, Nat. Hist. Fishes II, 1839, p. 259.
Nemophis Lessoni Kaup, Proc. Zool. Soc. London, Part XXVI, 1858, p. 168.
Xiphogadus setifer Günther, Cat. Brit. Mus. IV, 1862, p. 374.
Xiphasia tachypareia Bleeker. Versl. Akad. Amsterdam XVII, 1865, p. 196.

Xiphogadus madagascariensis Playfair, Proc. Zool. Soc. London 1868, p. 11.
Xiphasia setifer Day, Fishes of India, Part II, 1876, p. 337. Suppl. 1888, p. 799.
Xiphasia setifer Ramsay & Ogilby, Proc. Linn. Soc. New S. Wales (2) I, 1886, p. 583.
Nemophis Lessoni Sauvage, Poissons de Madagascar, 1891, p. 476.
Xiphasia setifer Tanaka, Journ. Sc. Coll. Tokyo XXIII, Art. 7, 1908, p. 49.
Xiphasia setifer McCulloch, Austral. Zool. I, Part III, 1922, p. 113.
Xiphasia setifer Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 849.
Xiphasia setifer Herre, Philip. Journ. Sc. XXXI, 1926, p. 224.
Xiphasia setifer Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 444.
Xiphasia setifer Hugh Smith, Journ. Siam Soc. Nat. Hist. Suppl. IX, N° 3, 1934, p. 323.
Xiphasia lessoni Hardenberg, Treubia XV, 1936, p. 378.
Xiphasia setifer Herre, Philip. Journ. Sc. LXX, 1939, p. 368.

D. 120-126. A. 97-111. P. 13. V. 3.

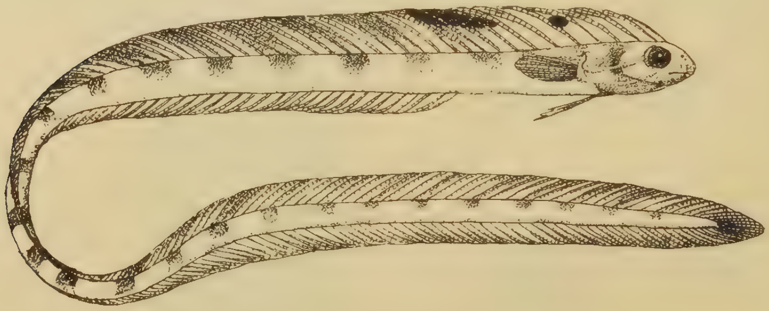

Fig. 54. *Xiphasia setifer Swainson.* × 4/5

Height 28.2-36.5, 29.1-37.5 in length with caudal. Head 13.5-14.5, 14-15 in length with caudal. Eye 3.7-3.9, about equal to snout. Interorbital space flat, 0.6-0.7 of eye. Mouth terminal, about horizontal, its corner before vertical through frontborder of eye. A single row of rather long, slender incisiviform teeth in the jaws. A posterior small canine in the upper jaw, and a very long one in the lower jaw. Gill opening a small, vertical slit, as long as the eye, the lower end of which is opposite to the superior part of the base of the pectoral. Dorsal tapering in height posteriorly, the anterior rays as long as head without snout, its origin above frontmargin of eye. Anal beginning far forward, the distance between its origin and tip of snout 6.45-6.9 in the total length with caudal, its depth anteriorly slightly less than that of dorsal. Both fins broadly united to the rounded caudal. Pectorals equal to postorbital part of head. Ventrals with the middle rays produced, half length of eye longer than pectorals. Lateral line probably represented by a narrow dark line or a slight furrow, running from upper half of gill opening along upper half of sides, soon disappearing on tail. Colour of preserved specimens yellowish grey, with about 25 more or less distinct brown cross bands on body and tail. Sometimes bands of a fainter colour between the first mentioned ones. The bands are continued on the dorsal, but they do not reach the ventral line, and hence are not continued on the anal, which is transparent light reddish brown as the dorsal. A small black, white edged ocellus between the 5th-6th dorsal rays, and another elongate one, more or less diffuse posteriorly, between the 10th-14th rays. Pectorals and ventrals of the colour of the body. Length 660 mm.

Habitat: Nias!; Celebes (Menado); Molucca's!; Flores!; South Coast of New Guinea! — Coast of Natal, Madagascar, Seychelles, Coasts of India, Siam, Japan, Philippines, New South Wales, New Hebrides, Lord Howe Island.

Note. The list of synonyms given above is a tentative one, and includes all species of the genus *Xiphasia* described. I have seen specimens from the Indo-Australian Archipelago only, and the description, given above, is based on these. My specimens have no caudal filaments, but this may either be due to the fact, that they are comparatively small (262-329 mm), or the filaments may have been broken. In colour my specimens best agree with Tanaka's figure (l.c. Pl. IV, fig. 1), the dark markings on the dorsal being the same. The bands on the body are somewhat differently distributed, and the blue lines and dots have disappeared, if at least they have been present.

2. Family CONGROGADIDAE

Much elongate, eel-like. Body, tail, and part of head covered with small cycloid scales. Jaws with a single series of conical, pointed, somewhat compressed teeth. Palate toothless or teeth on vomer. Gill openings wide or restricted. Gill membranes united, free from or united to isthmus. Dorsal and anal long, confluent with caudal. All the fin rays articulated, or the first of the dorsal spinous. Pectorals present. Ventrals generally absent.

Key to the Indo-Australian genera of Congrogadidae

a. No dorsal spine. Gill membranes united, free from isthmus . . . . . 1. *Congrogadus* p. 384.
b. First dorsal ray a short spine. Gill-membranes united to the isthmus . . 2. *Haliophis* p. 386.

1. **Congrogadus** Günther

(Günther, Cat. Brit. Mus. IV, 1862, p. 388)

Machaerium Richardson, Rep. Brit. Ass. XII (1842) 1843, p. 69 (preocupied).
Hierichthys Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 744.

Much elongate, eel-like. Body and tail, cheeks, preopercle, and part of opercle covered with minute cycloid scales. Gill membranes united, free from isthmus. Gill openings wide. No tentacles on head. Mouth rather wide. Teeth conical and pointed, in a single row in the jaws. Palate edentulous. Dorsal without spines, consisting of numerous articulated and divided rays only, its origin above pectorals. Anal long with about 60 rays. Dorsal, caudal, and anal confluent. Pectorals small. Ventrals absent. Lateral line incomplete. Six branchiostegals. Pseudobranchiae present.

Distribution. Two species from tropical parts of Indic, and tropical and subtropical parts of Pacific, ranging from the Nicobars in the West to Hawaii in the East.

1. **Congrogadus subducens** (Rich.) (Fig. 55, p. 385)

Machaerium subducens Richardson, Ann. Mag. Nat. Hist. XII, 1843, p. 176. — Voyage Erebus & Terror, Fishes, 1844-1848, p. 72.
Machaerium nebulatum Bleeker, Nat. Tijdschr. Ned. Indië II, 1852, p. 76. — Verh. Bat. Gen. XXIV, 1852. Bijdr. kennis Chirocentr. etc., p. 31.
Machaerium reticulatum Bleeker, Nat. Tijdschr. Ned. Indië III, 1852, p. 734.
Congrogadus subducens Günther, Cat. Brit. Mus. IV, 1862, p. 388.
Congrogadus subducens Kner, Novara Exp. Fische, 1865-1867, p. 280.
Congrogadus (Machaerium) subducens Steindachner, Sitzber. Akad. Wien LVI. 1. Abth. 1867, p. 318.
Congrogadus reticulatus Bleeker, Versl. Akad. Amsterdam (2) II (1867) 1868, p. 293.
Machaerium subducens Steindachner, Sitzber. Akad. Wien LX, 1869, p. 569.
Congrogadus subducens Macleay, Descr. Cat. Austr. Fish. I, 1881, p. 120.
Congrogadus subducens Vaillant, Bull. Soc. Philom. Paris (8) III, N° 1, 1891, p. 10.
Hierichthys encryptes Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 744.
Congrogadus subducens Jordan & Starks, ibid. XXXII, 1907, p. 504.
Congrogadus subducens Jordan & Richardson, Bull. Bur. Fish. XXVII (1907) 1908, p. 285.
Congrogadus encryptes Jordan, Tanaka & Snyder, Journ. Coll. Sc. Univ. Tokyo XXXIII, 1913, p. 398.
Congrogadus subducens M. Weber, Siboga Exp. Fische, 1913, p. 549.
Congrogadus subducens Whitley, Austr. Zoologist IV, Part IV, 1926, p. 236.
Congrogadus subducens Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 444.
Congrogadus subducens Whitley, Rec. Austr. Mus. XVII, N° 3, 1929, p. 108.
Congrogadus subducens Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 100. — Philip. Journ. Sc. LXX, 1939, p. 369.

D. 71-74. A. 60. P. 9-10. Sq. l about 120. Ltr. 46.

Height 8.3-9.3, 9.1-10 in length with caudal. Head 5.8-6.8, 6.4-7.3 in length with caudal. Eye 4.4-5.4, 1.3-1.7 in snout. Interorbital space convex, a little more than half diameter of eye. Mouth somewhat oblique. Maxillary reaching to below hindborder of eye or nearly so. A single row of pointed teeth in the jaws, none on the palate. Posterior nostril much larger than anterior one, closely before eye; both nostrils with a low rim. Opercle with a single spine. Origin of dorsal above tip of pectoral. Dorsal rays slightly increasing in height posteriorly, the longest about equal to snout and eye. Origin of anal twice nearer tip of snout than tip of caudal. Anal somewhat less deep than dorsal. Pectorals scarcely longer than snout. Caudal pointed. Colour of preserved specimens brownish uniform or mottled with darker. A dark ocellus on opercle may be present. According to Herre (l.c. 1939) the colour in life is highly variable. Specimens taken at the same time and place may be grass green, maroon, brownish red, dark brown, to pale yellowish; the colour may be almost uniform, but is usually irregularly spotted with darker spots of various sizes, and sprinkled with pearly spots which may form reticulations and cross bands. Underside of head and trunk usually much paler, with larger pearl-coloured or red spots on head, throat, and belly. Dorsal and anal membranes uniformly dark, or with one to several rows of dark spots. Sometimes conspicuous dark spots along base of vertical fins. A dark spot often present on opercle; it may be a definite ocellus, but is often absent. Length more than 500 mm.

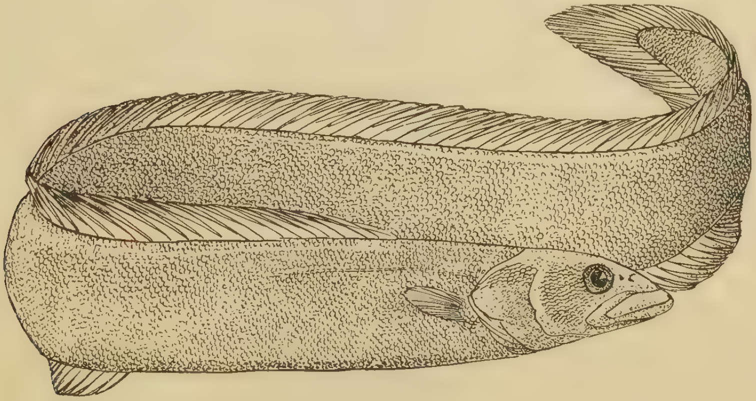

Fig. 55. *Congrogadus subducens (Rich.).* × 3/4

Habitat: Singapore; Bintang; Biliton; Banka; Sulu Islands; Borneo (Sandakan); Aru Islands!; New Guinea. — Nicobars, Riu Kiu Islands, Japan, Philippines, Thursday Island!, North and West Australia, Abrolhos Islands.

In sea and brackish water.

2. **Haliophis** Rüppell

(Rüppell, Atlas Reise Nördl. Afrika, Fische des Rothen Meeres, 1829, p. 49)

Much elongate, eel-like. Body and tail, cheeks, preopercle and part of opercle covered with minute cycloid scales. Gill membranes broadly united with sides of isthmus, the gill openings short vertical slits before the base of the pectorals. No tentacles on head. Mouth rather wide. Teeth rather large, conical or pointed, in a single row on the jaws and on vomer. Dorsal beginning behind head with a short but rather strong spine, followed by 44-62 divided rays. Anal with 36-50 rays. Dorsal, caudal, and anal confluent. Pectorals small. Ventrals absent. Lateral line complete or incomplete. Four branchiostegals.

Distribution. Two species are known: *H. guttatus* from the Red Sea and *H. malayanus* from the Australian Region.

1. **Haliophis malayanus** M. Web. (Fig. 56, p. 387)

Haliophis malayanus M. Weber, Notes Leyden Mus. XXXI, 1909, p. 145. — Siboga Exp. Fische, 1913, p. 550.
Haliophis malayanus McCulloch, Mem. Queensl. Mus. III, 1915, p. 55.

D. I. 58-62. A. 50. P. 9.

Height 8.4-10, 9.2-11 in length with caudal. Head 6.1-6.2, 6.6-7 in length with caudal. Eye 4.5-4.6, slightly more than snout. Interorbital space narrow, convex, three fifths of diameter of eye. Mouth oblique. Lips rather thick. Lower jaw the longer. Maxillary reaching to below frontborder of pupil. One well developed opercular spine. Lateral line incomplete, ending below 5th dorsal ray. Origin of dorsal above end of pectoral. Dorsal increasing in height posteriorly, the last rays about equal to postorbital part of head. Anal slightly less deep than dorsal. Pectorals as long as snout and half eye. Colour of preserved specimens yellowish brown; a large dark brown white edged ocellus on opercle, before the opercular spine. When fresh the specimens had 5-6 irregular longitudinal rows of light spots. Length 80 mm.

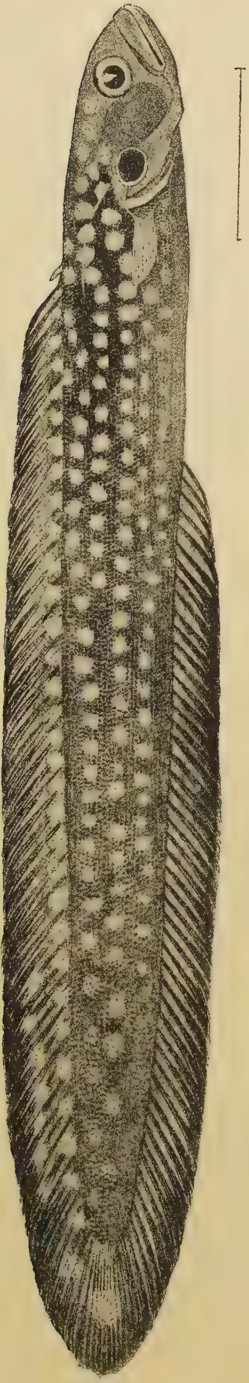

Fig. 56. *Haliophis malayanus* M. Web. × 2.2

Habitat Aru Islands! — North-Western Australia. In sea.

Note. *H. malayanus* differs from *H. guttatus* by having more rays in the dorsal and anal, and by having the lateral line incomplete. In this last respect it comes near to the genus *Congrogadoides* Borodin (Copeia 1933, N° 3, p. 141) but differs by having 4 branchiostegals, whereas *Congrogadoides* has 6.

3. Family NOTOGRAPTIDAE

Very elongate. Body and tail covered with small scales. Small teeth in several rows on jaws and palatines. No teeth on vomer. Mouth not protractile. Maxillary excluded from the gape, reduced to a slender rod. Vertical fins confluent. Each dorsal and anal ray, except the last two, which are branched, a slender pointed spine. Pectorals present. Ventrals jugular, consisting of one ray.

Distribution that of the single genus known.

1. **Notograptus** Günther

(Günther, Ann. Mag. Nat. Hist. (3) XX, 1867, p. 63.

Blanchardia Castelnau, Res. Rish. Austr. Intercol. Exhib. Essays. Victorian Dept. N° 2, 1875, p. 47.

Very elongate, eel-like. Body and tail covered with small cycloid scales. Head naked. Two nostrils, the anterior with a short tube. A short tentacle at symphysis of lower jaw. Mouth wide. Small teeth in several rows on jaws and palatines. None on vomer. Gill openings wide. Gill membranes attached to isthmus. Dorsal long with many spines, the anterior ones are flexible, the posterior ones pungent, and two divided rays. Anal long with many spines, and two divided rays. Dorsal and anal confluent with caudal. Ventrals jugular, consisting of one ray. One lateral line, running high up along base of dorsal.

Distribution: New Guinea, North and West Australia.

1. **Notograptus guttatus** Gthr (Fig. 57, p. 389)

Notograptus guttatus Günther, Ann. Mag. Nat. Hist. (3) X, 1867, p. 64.

Blanchardia maculata Castelnau, Researches on the fishes of Australia, Intercol. Exhib. Essays. Victorian Dept. N° 2, 1875, p. 47 (fide Ogilby, Mem. Queensl. Mus. I, 1912, p. 216).

Notograptus guttatus Macleay, Proc. Linn. Soc. New S. Wales II, 1878, p. 359. Descr. Cat. Austr. Fish. II, 1881, p. 30.

Notograptus guttatus McCulloch, Mem. Queensl. Mus. VI, 1918, p. 94.

D. LXVIII. 2. A. XLI. 2. P. 19. V. 1. Sq.l. about 200. Ltr. 31.

Height 11.8, 12.9 in length with caudal. Head 7.1, 7.8 in length with caudal. Eye 6.6, equal to snout and to almost flat interorbital space. Mouth wide, horizontal. Maxillary reaching far beyond eye, and to the middle of the length of the head. Small teeth forming bands on jaws, the bands tapering posteriorly. Similar teeth in an oval elongate patch on palatines. No teeth on vomer. Anterior nostril with a short tube. Mental barbel nearly as long as eye. Origin of dorsal above gill opening. Spines of dorsal posteriorly more pungent than anteriorly, prolonged with a short filament beyond the membrane. The longest spine about as long as half length of head. Distance of origin of anal from tip of snout about three fourths of its distance from tip of caudal. Anal spines more pungent posteriorly than anteriorly. Pectorals pointed, more than half as long as head. Ventrals nearly as long as snout and eye. Caudal pointed. Colour of preserved specimen uniform brownish grey, the fins hyaline. According to the descriptions this species is spotted with dark brown when fresh. Length 130 mm.

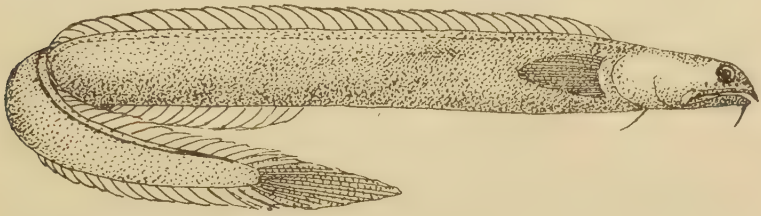

Fig. 57. *Notograptus guttatus* Gthr. × 1$^1/_4$

Habitat: New Guinea (Fly river!). — North Australia.

4. Family CLINIDAE

Body usually scaly. Dorsal with the spinous portion more extended than the soft, or with all the rays spinous. Dorsal often consisting of two or three separate fins. Anal with or without a few spines anteriorly. Caudal free. Pectorals present. Ventrals jugular, with or without a spine and with 2-4 rays. Gill membranes united, free from isthmus. Mouth protractile. Conical or villiform teeth in jaws and often on vomer and palatines.

Key to the Indo-Australian genera of Clinidae

a. Two dorsals, the first with 3 spines, on posterior part of head, the second with many spines and a few articulated rays	1. *Cristiceps* p. 390.
b. Three dorsals, the first with 3-4 spines, on posterior part of head, the second one spinous, and the third consisting of articulated rays	2. *Tripterygion* p. 392.

1. **Cristiceps** Cuvier & Valenciennes

(Cuvier & Valenciennes, Hist. Nat. Poissons, XI, 1836, p. 194, p. 402)

Body rather elongate, compressed. Small scales imbedded in the skin. Two nostrils, the anterior often with a tentacle. A tentacle above each eye generally present. Mouth oblique, moderate. Small teeth in several rows in jaws, on vomer and present or absent on palatines. Gill membranes free from isthmus. Gill opening wide. Two dorsals, the first with III spines, on posterior part of head, well separated from the second, which has XXV-XXX pungent spines and 3-8 articulated rays. Anal with II pungent spines and 19-25 rays. The last dorsal ray may be united with the caudal. Ventrals jugular, with I spine and 2-3 rays. Viviparous.

Distribution. Small fishes, occurring on reefs, some species entering fresh water. Mediterranean, Japan, Australia, Tasmania, Lord Howe Island, New Zealand. Indo-Australian Archipelago, Philippines.

Key to the Indo-Australian species of Cristiceps

a. Teeth on palatines present. Uniform yellow	1. *C. xanthosoma* p. 390.
b. No teeth on palatines. Yellowish, marbled with rose colour	2. *C. roseus* p. 391.

1. **Cristiceps xanthosoma** (Blkr.) (Fig. 58, p. 391)

Clinus xanthosoma Bleeker, Nat. Tijdschr. Ned Indië XIII, 1857, p. 340.
Cristiceps xanthosoma Günther, Cat. Brit. Mus. III, 1861, p. 340.
Cristiceps xanthosoma Herre, Philip. Journ. Sc. LIX, 1936, p. 371. — ibid. LXX, 1939, p. 321.

D^1. III. D^2. XXVII. 4-5. A. II. 19-21. P. 13. V. 3. Sq.l. 100-110.

Height 4.1-4.7, 5-5.5 in length with caudal. Head 4-4.1, 4.8-4.9 in length with caudal. Eye 3.9-4.4, equal to or somewhat more than snout. Interorbital space slightly convex, 1.6 in eye. A fimbriate fan-like tentacle on margin of each eye, half or more than half eye in length. A small simple nasal tentacle. Mouth strongly oblique, maxillary extending beneath frontmargin of pupil. Small teeth forming a band of 5 rows in front of upper jaw, the outer row consisting of somewhat larger teeth, dwindling to a single row posteriorly. Teeth in lower jaw larger, conical, in a single row, in about 2 rows at symphysis. Minute teeth on vomer and palatines. Origin of first dorsal above hindborder of preopercle. Second dorsal beginning above base of pectoral. Height of first spine of first dorsal equal to head without snout. Longest spine of second dorsal as long as snout and eye together. The dorsal spines are pungent, the soft rays are simple, but articulated. Longest anal rays equal to snout and eye in length. Pectorals as long as head without snout. Ventrals somewhat shorter. Caudal slightly rounded, the rays projecting beyond the membrane. Lateral line with a sharp bent down behind pectoral. Colour of fresh specimens uniform yellow. Length 82 mm. (Typical specimens of Bleeker's collection in the Leiden Museum seen by me).

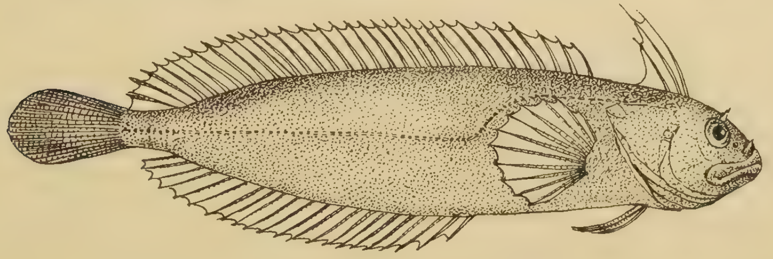

Fig. 58. *Cristiceps xanthosoma* (Blkr.). × 1^1/3

Habitat: Java (Karangbollong!). — Philippines.

2. **Cristiceps roseus** Gthr.

Cristiceps roseus Günther, Cat. Brit. Mus. III, 1861, p. 274.
Cristiceps roseus Macleay, Descr. Cat. Austr. Fish. II, 1881, p. 19.
Cristiceps roseus Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 428.
Petraites roseus McCulloch, Check-list Fishes Australia, Part III, 1929, p. 349.

D^1. III. D^2. XXV-XXVI. 4. A. II. 20-21. P. 12. V. I. 3.

Height 5, head 4.4 in total length. Snout subconical, equal in length to eye, with the lower jaw prominent. Teeth on the vomer, none on the palatines. The width of the interorbital space is much less than the vertical diameter of the eye. A fringed tentacle at nostril, that above orbit well developed, with obtuse fringes. Scales rudimentary. The first dorsal situated on the nape, above the opercle; it is somewhat higher than the second dorsal. The last dorsal ray is fixed by a membrane to the base of the caudal. The anal is quite free from it. The inner ventral ray is not half so long as the middle one. Yellowish (in spirits). Head, body, and the first dorsal marbled with rose colour. Second dorsal, anal, and pectorals with rose coloured cross bars. Length 95 mm. (After Günther, not seen by me).

Habitat: New Guinea. — Australia, Lord Howe Island.

2. **Tripterygion** Risso

(Risso, Hist. Nat. Princip. Product. de l'Europe Mérid. III, 1826, p. 241)

Tripterygium auctorum.
Enneapterygius Rüppell, Neue Wirbelthiere, Fische der rothen Meeres, 1835, p. 2.
Helcogramma McCulloch & Waite, Rec. South Austral. Mus. I, N° 1, 1918, p. 57.

Body moderately elongate, somewhat compressed. Scales ctenoid, small or of moderate size. Head and belly, sometimes also nape and anterior part of back without scales. A nasal and an orbital tentacle present or absent. Mouth moderate. Small pointed teeth in several rows on the jaws and on vomer, present or absent on palatines. Gill membranes united, free from isthmus. Gill openings wide. Three dorsals, the first with III-IV flexible spines, beginning on posterior part of head, the second with IX-XXIV flexible spines and the third with 8-15 undivided but articulated rays. Anal with 19-26 articulated rays. Ventrals jugular, with 2 rays. Pseudobranchiae present. Lateral line incomplete or interrupted.

Distribution. Small fishes living near coasts on reefs or among vegetation of the Mediterranean, Red Sea, Indic, and Pacific, but not reaching the American coast of lastnamed ocean.

Key to the Indo-Australian species of Tripterygion

A. Sq.l. 42-50. Nape naked. Second dorsal with XIII-XIV spines. No orbital tentacle.

  a. First spine of first dorsal half as long as that of second dorsal. Sq.l. about 50. Space below second dorsal scaly . . . . 1. *T. trigloides* p. 393.
  b. First spine of first dorsal two thirds of that of second dorsal. Sq.l. 42. Space below anterior half of second dorsal without scales . 2. *T. gymnauchen* p. 394.
B. Sq.l. 28-33. Nape scaled. Second dorsal with IX-XII spines. An orbital tentacle.
  a. Sq.l. 28. Whitish with large brown spots along the middle of the sides 3. *T. waigiense* p. 395.
  b. Sq.l. 30-33.
    a^1. First spine of first dorsal half as long as that of second dorsal 4. *T. callionymi* p. 395.
    b^1. First spine of first dorsal three fourths of that of second dorsal 5. *T. fasciatum* p. 396.

1. **Tripterygion trigloides** Blkr

Tripterygion trigloides Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 234.
Tripterygium trigloides Günther, Cat. Brit. Mus. III, 1861, p. 279.
Tripterygium trigloides M. Weber, Siboga Exp. Fische, 1913, p. 545.
Tripterygium trigloides Herre, Notes Fishes Zool. Mus. Stanf. Univ. 1934, p. 95.
Tripterygion trigloides Herre, Philip. Journ. Sc. LXX, 1939, p. 318.

D^1. III. D^2. XIII. D^3. 10. A. 19. P. 16. V. 2. Ll. 50. Ltr. 15.

Height 5.1, 6.1 in length with caudal. Head 3.2, 3.9 in length with caudal. Eye 3.2. Snout about five sixths of eye. Interorbital space very narrow, one fourth of eye. Mouth slightly oblique. Corner of mouth below frontborder of eye. Pointed somewhat hooked teeth in several rows in the jaws, those of the outer row slightly enlarged. Minute teeth on vomer. Head, nape, and back below first dorsal, as well as thorax and belly, naked. Origin of first dorsal above hindborder of preopercle, the first spine of this fin about half as long as that of the second dorsal. Third dorsal consisting of articulated rays. The spines of first and second dorsal not pungent. Anal rays articulated, the origin of this fin below the middle of the second dorsal. Pectorals nearly as long as head. Upper 9 or 10 pectoral rays divided, the lower ones undivided. Inner ventral ray the longer, about equal to head without snout. Caudal rounded. Lateral line curved down to middle of sides, ending below begin of third dorsal. The specimen examined by me is now colourless, but according to Herre alcohol specimens are reddish brown to pale tan, with irregular spots and flecks of silvery white scattered on sides; over back and down sides 5 double cross bars, varying from dark red brown to blackish; top and sides of head thickly sprinkled with black dots. Upper lip dark purple to blackish, dorsals and caudal barred with dusky bands, or dorsals largely covered with dark red brown specks; anal varying from clear, with a few red brown spots or bands, to entirely dusky. In life this blenny is very handsome, largely rose red, with iridescent spots and flecks of pearly blue. Length 38 mm.

Habitat: Biliton; Lembeh Strait; Tiur! — Philippines.
In sea, on reefs.

2. **Tripterygion gymnauchen** M. Web.

Tripterygium gymnauchen M. Weber, Notes Leyden Mus. XXXI, 1909, p. 149. — Siboga Exp. Fische, 1913, p. 548.

D^1. III. D^2. XIV. D^3. 10. A. 20. P. 16. Ll. about 42.

Height 5.4, 6.3 in length with caudal. Head 3.2, 3.7 in length with caudal. Eye 2.8. Snout two thirds of eye. Interorbital space one third of eye. Mouth somewhat oblique. Corner of mouth below anterior half of eye. Small teeth in jaws and on vomer, the outer teeth in the upper jaw slightly enlarged. Lips rather thick. Gill membranes united, free from isthmus. Gill opening wide. A small nasal tentacle, no orbital tentacles. Body covered with ctenoid scales. Head and a strip along base of first dorsal and of anterior half of second dorsal naked. Lateral line gently sloping down to middle of sides, ending abruptly after having perforated 22 scales, below origin of third dorsal. First spine of first dorsal about midway between hindborder of preopercle and that of opercle, about two thirds of length of first spine of second dorsal. Second dorsal and third dorsal of equal height. Spines of first and second dorsal flexible, not pungent. Rays of third dorsal articulated, as well as those of anal, which originates below 6th spine of second dorsal. Pectorals with the 8 upper rays divided, as long as head. Inner ventral ray the longer, equal to postorbital part of head and half eye. Caudal slightly rounded. Colour in alcohol dark brown with darker punctulations and a few light spots. Length of single specimen known 30 mm.

Habitat: Timor! On reef.

3. **Tripterygion waigiense** (Herre)

Enneapterygius waigiensis Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII, N° 12, 1935, p. 434.

D^1. III. D^2. IX-X. D^3. VIII. A. I. XIII.

There are 28 scales in a longitudinal series plus 2 more on the tail, and 7 or 8 in a transverse series. The lateral line extends back only a short distance and consists of 8 tubes. Height 4.5-4.85, head 3.25-3.5. The maxillary equals the eye, which is 2.65 in head. The pointed snout is 3-3.2 in head. The interorbital space is 2.5 times in the eye. The elongate pectoral is 3.2 in the length. The ventral is 1.3-1.7. There is a small simple tentacle on the upper margin of the eye. The colour in alcohol is whitish, with seven or eight conspicuous blackish brown spots beneath the anal, and a row of large brown spots along the middle of the side. Most of the scales are margined by a band of minute brown dots, with similar dots thickly sprinkled over the breast and sides of the head. The first and second dorsal are blackish, the remaining fins all cross barred by rows of blackish brown spots. Length 19 mm. (After Herre, not seen by me).

Habitat: Waigeu. On reefs.

4. **Tripterygion callionymi** M. Web.

Tripterygium callionymi M. Weber, Notes Leyden Mus. XXXI, 1909, p. 147. — Siboga Exp. Fische, 1913, p. 546.
Tripterygium (*callionymi* var.?) M. Weber, ibid. p. 547.
Tripterygion callionymi Herre, Philip. Journ. Sc. LXX, 1939, p. 318.

D^1. III. D^2. XI-XII. D^3. 8-9. P. 15-16. V. 2. Ll. 31-33. Ltr. $\begin{array}{c}3\\ \hline 1\\ \hline 6\end{array}$.

Height 4.6-4.7, 5.3-5.7 in length with caudal. Head 3.3-4, 4.1-4.8 in length with caudal. Eye 3.2-4, equal to or slightly less than snout. Interorbital space one half or two fifths of eye. Mouth slightly oblique. Corner of mouth below frontborder of eye. Small teeth in several rows in jaws, the outer row near symphysis consisting of slightly enlarged teeth. Vomer with minute teeth. Lips rather thick. A small simple nasal tentacle, and a similar orbital one. Gill membranes united, free from isthmus. Gill opening wide. Head and belly naked, nape scaly. Scales ctenoid. Lateral line without abrupt curve, extending back on 14-15 scales, and continued two scales lower down to caudal, represented here by semicircular emarginations of the hindborders of the scales. First spine of first dorsal slightly behind hindborder of preopercle, about half as long as first spine of second dorsal, which is somewhat higher than the third. Spines of first and second dorsal flexible, not pungent. Rays of third dorsal articulated. Anal rays articulated, the origin of this fin below fourth spine of second dorsal. Pectorals about half length of snout shorter than head. Upper 8 or 9 pectoral rays divided, the lower ones undivided. Inner ventral ray longer than the outer one, about as long as pectoral. Caudal truncate. Colour of preserved specimens light brownish, more or less freckled with dark and with irregular chalky white spots, generally more conspicuous on under side of head and on belly. Fins hyaline or with indications of bands. Pectorals sometimes broadly barred with dark and light. Length 35 mm.

Habitat: Lombok!; Muaras Reef in Celebes Sea!; Sula Islands!; South Island near Saleyer!; Tiur! — Philippines.
On reefs.

5. **Tripterygion fasciatum** M. Web. (Fig. 59, p. 397)

Tripterygium fasciatum M. Weber, Siboga Exp. Fische, 1913, p. 548.
Tripterygion (Enneapterygius) fasciatum Mukerji, Rec. Indian Mus. XXXVII, Part III, 1935, p. 272.
Tripterygion fasciatum Herre, ibid. XLI, Part IV, 1939, p. 351.

D^1. III. D^2. XII. D^3. 7-8. A. 18. P. 16. Ll. 30-31. Ltr. $\begin{array}{c}2\frac{1}{2}\\ \hline 1\\ \hline 6\end{array}$.

Height 4.4-4.9, 5.5-5.7 in length with caudal. Head 3.1, 3.6-3.9 in length with caudal. Eye 3.5, slightly more than snout. Interorbital space slightly concave, about one fourth of eye. Mouth slightly oblique. Corner of mouth below anterior half of eye. Teeth minute, none of them enlarged. Gill membranes united, free from isthmus. Gill openings rather wide. Head and belly naked, nape scaled. Scales ctenoid. Lateral line without abrupt curve, extending back on 18 scales, and continued two scales lower down to caudal, represented here by semicircular emarginations of the hindborders of the scales. First spine of first dorsal midway between hindborder of preopercle and that of opercle, its length about three fourths of that of second dorsal, which is about as high as third dorsal. Spines of first and second dorsal flexible. Rays of third dorsal as well as those of anal articulated. Origin of anal below 6th or 7th spine of second dorsal. Pectorals as long as head, the 7 upper rays divided, the lower ones undivided. Caudal truncate. Colour of preserved specimen yellowish with 7 irregular brown cross bands, the four anterior ones irregularly connected with each other. Head freckled and banded with brown. First and second dorsal dark at base, the third one with 3-4 brown oblique bands. Anal hyaline, with indications of seven dark dots. Pectorals finely speckled. Caudal dark at base. Length 27 mm.

Habitat: Karakelang!; Savu! — Andamans. On reefs.

Note. Herre's specimen from the Andamans has four spines in the first dorsal.

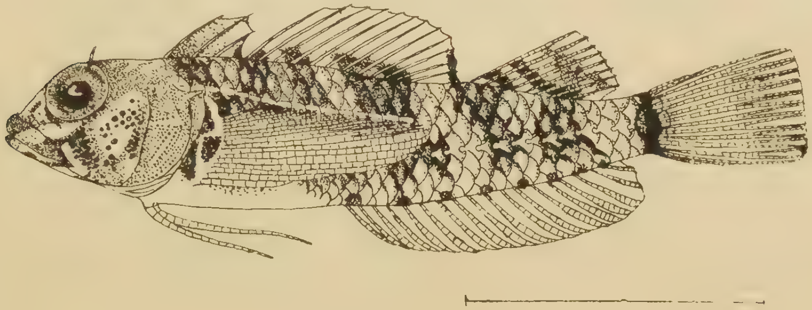

Fig. 59. *Tripterygion fasciatum* M. Web. × 4

Doubtful species

Blennius periophthalmoides Macl.

Blennius periophthalmoides Macleay, Proc. Linn. Soc. New S. Wales VIII, 1883, p. 269.

Hypleurochilus periophthalmoides Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 421.

Hypleurochilus periophthalmoides Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 432.

D. 12. 16. A. 18. P. 14. V. 2.

Body much compressed, its height about one sixth of the total length. Head as high as long, and broader than the length, quite round in front, and with two very prominent eyes nearly together on the top of the head. Mouth terminal, extending to below the middle of the eye. Gill membranes entirely united below. Pectoral fins strong, of 14 simple rays; dorsal distinctly notched; caudal rounded. All the fins seem to have been marked with alternate brown and white bars, giving them a spotted appearance, according to Mr. Goldie the body was of an inky drab colour.

"Pici" of the natives.

Habitat: Dufoure Island, S. E. New Guinea.

This description is a copy of that given by Macleay. The species has never been rediscribed or found back, and as nothing is said about the dentition it is impossible to give it its proper place. Jordan & Seale, and Fowler placed it in the genus *Hypleurochilus,* created by Gill for an Atlantic species. In this genus the gill openings are restricted to the sides, there are large hooked canines in the upper and the lower jaw, and the dorsal is not notched. It seems to be close to *Petroscirtes* and *Blennius periophthalmoides* might as well belong to lastnamed genus. The notched dorsal makes it however improbable that it belongs to either genus.

Clinus cottoides C. V.

Kner (Novara Exp. Fische I, 1865-1867, p. 202) described specimens of this species which came with certainty from the Cape of Good Hope, but others are said to be from Java ("für einige Exemplare als Fundort Java angegeben wird"). This is most probably erroneous: *Clinus cottoides* has never been found outside South Africa.

5. Family BROTULIDAE

Elongate, compressed. Body and tapering tail covered with small cycloid scales, sometimes naked. Dorsal and anal well developed, long, and generally more or less confluent with the reduced caudal, seldom the caudal is free. Ventrals, when present, jugular. Vent generally remote from the head. Mouth generally protractile. Gill openings wide, gill membranes separate and free from isthmus. An opercular spine generally present. Many species are living in the deep sea, and those often with the bones of the head thin, and with mucous cavities.

Key to the Indo-Australian genera of Brotulidae[1])

I. Snout and lower jaw with well developed barbels. Ventral rays bifid 1. *Brotula* p. 403.
II. Snout and lower jaw without barbels.
    A. Body naked. Lateral line absent.

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[1]) This key is largely based on that given by Norman (John Murray Exp. Sc. Rep. VII, N° 1, Fishes, 1939, p. 80).

Origin of dorsal very little in advance of that of anal.
- *a*. Body short or of moderate length, tail not tapering, vent not very far in advance of middle of total length. Eyes visible through skin . . . . 2. *Barathronus* p. 405.
- *b*. Body elongate, compressed, tail tapering, vent below pectorals. 3. *Pyramodon* p. 406.

B. Body covered with scales.
- *a*. Gill rakers on anterior arch usually well developed; at least 6 long pointed gill rakers, inclusive of rudiments, on lower part of arch. Head normally entirely scaled. Species, as far as known, oviparous.
  - a^1. Eyes absent or hidden beneath the skin. Preopercle and opercle without spines. Mouth small, inferior. . . 4. *Typhlonus* p. 408.
  - b^1. Eyes developed.
    - a^2. Preopercular and opercular spines very strong, the longest projecting beyond the margin of the operculum. Head large, broad, without crests . . . . 5. *Acanthonus* p. 409.
    - b^2. Preopercular and opercular spines, if present, of small or moderate size, the longest not projecting beyond the margin of the operculum.
      - a^3. Head with prominent frill-like crests, the bones thin, covered with deciduous scales. Opercle with a feeble, flat spine.
        - a^4. No lateral line. Pseudobranchiae well developed. Ventrals present 6. *Glyptophidium* p. 410.
        - b^4. Lateral line very broad, conspicuous, with a series of enlarged, plate-like

scales. No pseudobranchiae. No ventrals . . . 7. *Lamprogrammus* p. 412.

b^3. Head without prominent, frill-like crests. Lateral line, if developed, narrow, without specially modified scales.

a^4. Lateral line usually distinct, disappearing at middle or posterior part of body.

a^5. Pectoral fins simple, none of the rays prolonged.

a^6. Ventrals bifid. Bones of head firm . . . . . . 8. *Neobythites* p. 415.

b^6. Ventrals simple. Bones of the head weaker, more cavernous.

a^7. Lateral line terminating on posterior part of the body . 9. *Monomitopus* p. 419.

b^7. Lateral line terminating at middle of body . . . . . . 10. *Monomeropus* p. 420.

b^5. Lower pectoral rays prolonged, free or partly connected by membrane . . . 11. *Dicrolene* p. 421.

b^4. Lateral line indistinct, rudimentary or absent, sometimes represented by one or more series of small pores. Eyes usually rather small.

a^5. Teeth in villiform bands. Gill rakers long, at least near angle of arch.

a^6. Snout more or less swollen, pointed, produced above the mouth, which is small . . . 12. *Barathrodemus* p. 424.

b^6. Snout not produced above the mouth, which is terminal.

a^7. Head without large, distinct mucous cavities or pores, with a heavy covering of skin, which obscures angles of skull. Opercular spine strong . 13. *Bassogigas* p. 426.

b^7. Head with large, distinct mucous cavities or pores. Angles of skull not usually obscured by thick, heavy skin.

a^8. Preopercle expanded posteriorly to form a broad, rounded lobe, which sometimes extends nearly to edge of opercle; margin of preopercle without large mucous cavities. Opercle unarmed or with a single, feeble, flat spine.

a^9. Lower half of pectoral fin produced, rigid, oar-like. Ventral rays simple. 14. *Eretmichthys* p. 427.

b^9. Pectoral fins simple, none of the rays prolonged.

a^{10}. Ventral rays bifid. Preopercular lobe not nearly reaching edge of opercle. 15. *Alcockia* p. 428.

b^{10}. Ventral rays simple. Preopercular lobe nearly reaching edge of opercle. 16. *Bassozetus* p. 430.

b^8. Preopercle not expanded posteriorly, its margin with a series of large mucous cavities.

a^9. Pectoral rays greatly produced, their basal portion narrow, constricted, thickened, distal portion filamentous, the rays more or less separated . . 17. *Mastigopterus* p. 434.

b^9. Pectoral fins shorter than the head, none of the rays prolongated . . 18. *Moebia* p. 435.

b^5. Teeth small, in a single series in jaws, and on vomer and palatines. Gill rakers few, small tubercle-like . . 19. *Enchelybrotula* p. 437.

b. Gill rakers on anterior arch usually reduced to a few well developed rakers near angle of arch; 2 to 5 only on lower part of arch, remainder rudimentary. Head usually only partly scaled, sometimes entirely naked. Species as far as known viviparous.

a^1. Caudal fin differentiated, entirely free from dorsal and anal. Cheeks and opercle scaled . . . . . 20. *Dinematichthys* p. 438.

b^1. Caudal fin not differentiated, united with dorsal and anal.

a^2. Ventrals present, sometimes very small. Preopercle unarmed.

a^3. Lateral line double, narrow, indistinct. No canines . . . 21. *Cataetyx* p. 439.

b^3. Lateral line single, broad anteriorly, becoming narrow posteriorly. A pair of canines in the upper jaw . . . . 22. *Hypopleuron* p. 441.

b^2. Ventrals absent.

a^3. Head normal; cheeks and opercles scaled. Margin of preopercle with 5 or 6 spines . . . . 23. *Xenobythites* p. 442.

b^3. Head greatly delated, covered with a thick, gelatinous, scaleless skin . . . 24. *Hephtocara* p. 444.

1. **Brotula** Cuvier

(Cuvier, Règne Animal, 2d. ed. II, 1829, p. 335)

Elongate. Head, body, and tail covered with small cycloid scales. Lateral line complete, running slightly above median line of sides. Mouth rather large. Bands of villiform teeth on the jaws, the vomer, and the palatines. Upper and lower jaw with barbels. Gill membranes free from isthmus and from each other. Pseudobranchiae rudimentary. Eye oblong, moderate, without free orbital margin. Dorsal, anal, and caudal confluent. Dorsal and anal long, many-rayed, covered with minute thin scales. Pectorals rounded. Ventrals consisting of 2 rays, close together, below symphysis of cleithra.

Distribution. A few species in coastal waters from the Atlantic, Indic, and Pacific.

Key to the Indo-Australian species of Brotula

a. D + A + C about 160 . . . . . . 1. *B. multibarbata* p. 403.

b. D + A + C more than 200 . . . 2. *B. maculata* p. 404.

1. **Brotula multibarbata** Schl. (Fig. 60, p. 404)

Brotula multibarbata Schlegel, Fauna Japonica, Pisces, 1847, p. 251.

Brotula multibarbata Bleeker, Nat. Tijdschr. Ned. Indië XIII, 1857, p. 75.

Brotula multibarbata Klunzinger, Verh. zool. bot. Ges. Wien XXI, 1871, p. 574.

Brotula multibarbata Day, Fishes of India, Suppl. 1888, p. 804.

Brotula multibarbata Boulenger, Proc. Zool. Soc. London, 1889, p. 241.

Brotula multibarbata Steindachner, Ann. Naturh. Hofmus. XI, Heft 2, 1896, p. 216.

Brotula multibarbata Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 754.

Brotula multibarbata Günther, Fische der Südsee, Heft VIII, 1909, p. 332.

Brotula multibarbata M. Weber, Siboga Exp. Fische, 1913, p. 556.

Brotula multibarbata Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 445. — Monogr. Ac. Nat. Sc. Philadelphia II, 1938, p. 115.

D + A + C = about 160. P. 22. V. 2.

Height equal to length of head, 5.1, 5.4 in length with caudal. Eye 4.2, slightly more than snout. Interorbital space convex. 1.7 in eye. Barbels longer than eye, outer mandibulary barbel longer than the others, equal to snout and half eye. Mouth oblique. Maxillary dilated behind, reaching almost to below hindborder of eye. Origin of dorsal above middle of pectoral. Dorsal rays somewhat increasing in length posteriorly, the longest equal to snout and half eye. Origin of anal one fifth of total length nearer to tip of snout than to tip of caudal, its distance from head more than length of head. Anal as deep as dorsal. Pectorals as long as eye and snout. Ventrals equal to postorbital part of head. Colour of preserved specimen reddish brown. Dorsal and anal with a blackish subterminal band, and a very narrow white edge. A narrow black ring round the eye. Length 600 mm.

Habitat: Celebes (Panawanko); Buru; Ambon; Banda!; Timor; New Guinea (Humboldt Bay!). — Red Sea, Arabian Sea, Coasts of India, Christmas Island, Japan, Riu Kiu Islands, Formosa, Paumotu Islands, Hawaii.

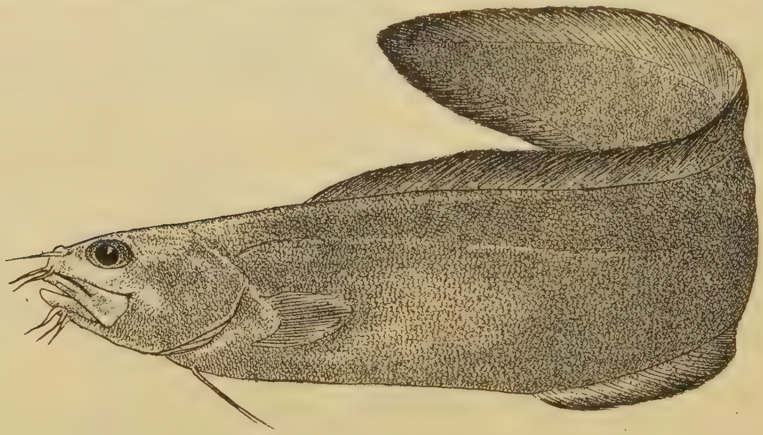

Fig. 60. *Brotula multibarbata* Schl. × ½.

Note. Boulenger l.c. has expressed his opinion that the following species: *B. maculata* as well as *B. ensiformis* Gthr do not differ from *multibarbata*. I have not been able to study these species, but judging from the descriptions Boulenger may be right.

2. **Brotula maculata** Day

Brotula maculata Day, Proc. Zool. Soc. London, 1868, p. 196. — Fishes of India, Part II, 1878, p. 419.

Brotula maculata Günther, Fische der Südsee, Heft VIII, 1909, p. 332.

D. 100-115. A. 97-107. P. 23. V. 2.

Height equal to head, 5.5, 6 in total length. Length of head less than its distance from anal. Interorbital space less than eye, which is as long as snout and one fifth of head. Jaws equal in front. Maxillary reaching to below eye. The six upper barbels are always as long as eye, the six lower ones are somewhat longer. The band of teeth on the palate is as broad as the anterior part of the band on the upper jaw, and as long as the eye. Pectorals half as long as head, and almost as long as the inner ventral ray. Vertical fins with a narrow, black, exteriorly white, edge. Length 275 mm (Compiled, not seen by me).

Habitat: New Guinea. — Coast of India.

Note. The chief difference between *multibarbata* and *maculata* seems to be the number of dorsal and anal rays, which is greater in the latter. It is, however, extremely difficult to count these rays acurately; between the normal rays there are often spurious ones, which do not reach to the base of the fin, and it makes a great difference if these rays are counted or left out. As said above, Boulenger considers them synonyms. Hubbs (Copeia 1944, n° 3. p. 162) who revised the genus *Brotula,* comes to the same conclusion. According to him, *B. maculata* is based on young specimens of *B. multibarbata.*

2. **Barathronus** Goode & Bean

(Goode & Bean, Bull. Mus. Comp. Zool. XII, 1885, p. 164)

Elongate, compressed. Head broader than body. No scales. Mouth oblique. Eyes rudimentary. Teeth in upper jaw rudimentary, small in lower jaw, fang-like on head of vomer, and absent on palatines. Nostrils close together and small. No barbels. Head full of muciferous channels. Gill membranes more or less united, free from isthmus. Gill openings large. Gill laminae well developed on all arches. Gill rakers very numerous and slender, and rather long. No pseudobranchiae. Vent far behind pectorals. No lateral line. Origin of dorsal far behind pectorals, not much in front of that of anal. Ventrals reduced to a single simple ray. Caudal scarcely differentiated, composed of rather numerous very slender rays upon a somewhat narrow base.

Distribution. Four deep sea species from the Atlantic and the Indic.

1. **Barathronus diaphanus** Brauer (Fig. 61, p. 406)

Barathronus diaphanus Brauer, Wiss. Ergeb. Valdivia. XV. Die Tiefsee-Fische. I. Syst. Teil, 1906, p. 305.
Barathronus diaphanus M. Weber, Siboga Exp. Fische, 1913, p. 551.

D. 64. A. 50. P. 25. V. 1.

Height 5.36, 5.8 in length with caudal. Head 4.2, 4.57 in length with caudal. Eye high up, rudimentary, unpigmented, with exception of a very small black spot at the back of the eye. Mouth very oblique, maxillary reaching about below hindborder of eye. Origin of dorsal somewhat nearer tip of snout than tip of caudal; origin of anal slightly nearer tip of caudal than tip of snout. Pectorals slightly shorter than ventrals, and about equal to distance between corner of mouth and gill opening. The preserved specimen described is transparent yellowish; when fresh it was reddish with the abdomen darker. Length 124 mm.

Habitat: Timor Sea, 918 M, mud! — Coast of East Africa, 1289 M., Andamans, 1728 M.

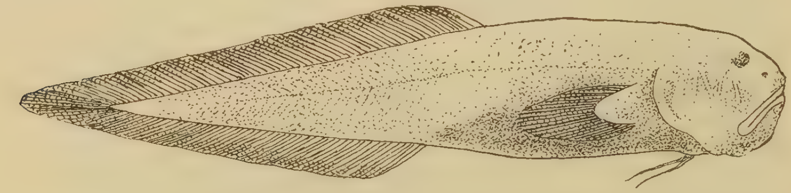

Fig. 61. *Barathronus diaphanus* Brauer. After Brauer.

3. **Pyramodon** Smith & Radcliffe

(Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 175)

Cynophidium Tate Regan, Ann. Mag. Nat. Hist. (8) XIII, 1914, p. 16.

Body deep, compressed, produced into a long slender tail. No scales. Eyes with a free orbital margin. Mouth rather large. A median row of small canine-like teeth on sides of mandible and a short inner and outer row of smaller teeth anteriorly. A short toothless space in front of lateral series and a pair of long, curved canines one on either side of symphysis at tip of mandible, fitting into a groove behind a pair of similar more widely separated fangs on upper jaw. A rather wide band of small cardiform teeth on sides of premaxillary, the inner row depressible; a long fang on head of vomer, a number of small conical teeth on palatines, anterior ones largest. Gill membranes separate, free from isthmus. Dorsal and anal continuous with the caudal. Ventrals present, each consisting of a slender filament. Pectorals long. Vent below base of pectorals. Lateral line absent. Pseudobranchiae represented by 2 small filaments. Branchiostegals 7.

Distribution. Two deep sea species are known, one from the Indo-Australian Archipelago, and one from New Zealand.

1. **Pyramodon ventralis,** Sm. & Radcl. (Fig. 62, p. 407)

Pyramodon ventralis Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 175.

D. about 140. A. about 140. C. 4. V. 1. P. 26.

Head 6.43 in total length. Greatest body depth 6.75 in total length. Eye 4.84, large. Snout equal to eye. Mouth large, upper jaw overlapping lower, except at tip. Maxillary extending 0.83 of an eye diameter beyond vertical from posterior margin of eye. Opercle bearing 2 inconspicuous diverging ridges ending in a spine-like tip. Margin of preopercle adnate in its upper half, free below, unarmed. Origin of dorsal from tip of snout 5.02 in total length. Dorsal rays shorter and weaker than those of anal. Anterior anal longest. Origin of anal under second dorsal ray. Ventrals one third the length of the head, bases close together behind tip of humeral symphysis. Pectorals broad, the median rays longest, nearly 1.33 times length of head. Colour in alcohol ochraceous buff, dotted with small pigment spots. Belly more or less silvery. Fins straw colour. Posterior rays of dorsal, anal, and adjacent part of tail somewhat darker. Peritoneum brownish black. Length of single specimen known 196 mm (After Smith and Radcliffe, not seen by me).

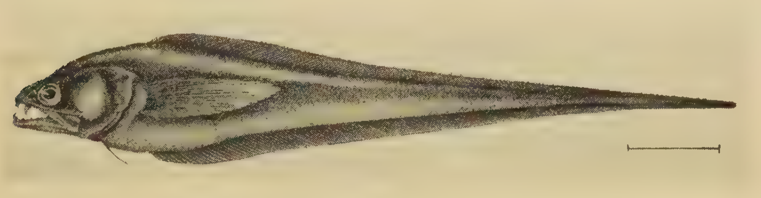

Fig. 62. *Pyramodon ventralis* Smith & Radcliffe. After Radcliffe.

Habitat: Near Doworra Island, at a depth of 369 M, on a bottom of coral sand.

4. **Typhlonus** Günther

(Günther, Ann. Mag. Nat. Hist. (5) II, 1878, p. 21)

Head large, compressed, with most of the bones in a cartilaginous condition, the superficial bones with enormous muciferous cavities, not armed. Snout a thick protuberance, projecting far beyond the mouth, which is rather small and inferior. Trunk very short, the vent being below the pectoral. Tail excessively compressed, deep, tapering, without separate caudal. Dorsal and anal long. Eye not visible externally, reduced to a minute rudiment hidden below the skin. Bands of villiform teeth in the jaws, on the vomer and palatines. No barbels. Ventrals reduced to simple filaments, placed close together on the symphysis of the cleithra. Gill openings very wide, the gill membranes being but slightly united in front. Gills four. Gill laminae very short. Gill rakers of moderate length. Scales thin, small, deciduous. No visible lateral line.

Distribution that of the single species known.

1. **Typhlonus nasus** Gthr. (Fig. 63, p. 409)

Typhlonus nasus Günther, Ann. Mag. Nat. Hist. (5) II, 1878, p. 21. — Rep. Sc. Res. Challenger Exp. Zool. XXII, 1887, p. 119.
Typhlonus nasus Macleay, Descr. Cat. Austr. Fish. II, 1881, p. 118.

The depth of the body is not quite equal to the length of the head, which is rather more than one fourth of the total. Protuberances, formed by projecting portions of the cranium occupy the upper and lateral surfaces of the head; and more especially one in front, and another on each side of the snout are very conspicuous. Mouth horseshoe-shaped, quite at the lower side of the head. The nostrils are close together, situated on the lateral prominences of the snout. Origin of dorsal above the root of the pectoral. The distance of the vent from the root of the ventral is only half the length of the head. Pectorals rounded, with 26 feeble rays, reaching beyond the vent. Ventral filaments reaching beyond the extremity of the pectorals. Colour of preserved specimen light brownish, with black fins. Length 250 mm (After Günther, not seen by me).

Habitat: North of Celebes, 3870 M. — North-east of Australia, 3392 M.

5. **Acanthonus** Günther

(Günther, Ann. Mag. Nat. Hist. II, 1878, p. 22)

Head excessively large and thick, without crest, armed in front, on the preopercle, and on the opercle, with strong spines. Trunk very short, the vent being below the pectorals. Tail thin, strongly compressed, tapering, with the caudal distinct. Eye small. Mouth very wide, with the teeth in villiform bands on the jaws, the vomer and palatines, and along the hyoid. Barbel none. Ventrals each reducid to a bifid filament, placed close together far before pectorals. Gill membranes not united. Branchiostegals 9. Gill laminae remarkably short. Gill rakers long, lanceolate, stiff. Bones of the head soft, the superficial supporting large cavities.

Distribution: That of the single species known.

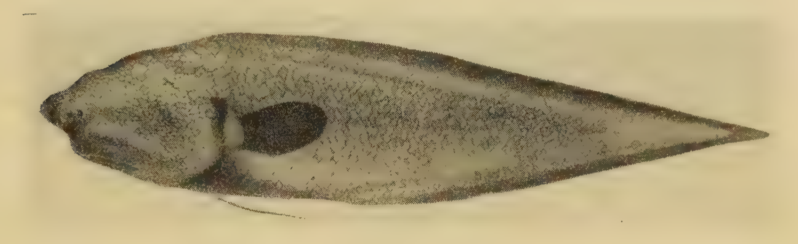

Fig. 63. *Typhlonus nasus* Gthr. After Günther.

1. **Acanthonus armatus** Gthr. (Fig. 64, p. 410)

Acanthonus armatus Günther, Ann. Mag. Nat. Hist. II, 1878, p. 22. — Challenger Rep. Zool. XXII, 1887, p. 117.

D + C + A = 100 + 3 + 88. P. 18. V. 2.

Length of body and tail not quite thrice that of the head. The head appears of an extraordinary thickness, compared with the thin and compressed trunk and tail; it is very broad across the frontal regions and not much longer than high; the small eye being much nearer to the end of the snout than to the gill opening. The snout would be truncated in front, but for its upper projecting portion which terminates in two short acute spines. The large mouth is slightly oblique, the maxillary extending backwards beyond the middle of the length of the head. The jaws are equal in front. Two sharp ridges run along each ramus of the mandible, to receive between them a wide muciferous channel. The angle of the preopercle is armed with four spines, three of which are placed on the outer edge of the bone; the upper is the longest and dagger-shaped, pointing backwards, the middle is shorter, broader, and points, like the third and smallest, downwards. The fourth is placed anteriorly to the first, arising from the anterior lamella of the bone, short and directed outwards. The longest spine of the head is part of the opercle, which otherwise is a very thin and narrow bone; the spine is nearly two fifths the length of the head, styliform, deeply grooved above and below, and points backwards. Nostrils rather close together, and on the side of the snout; a large mucous aperture in front of them, below the rostral spines. Entire head and body covered with minute, thin, deciduous scales. Lateral line represented by a series of small, distant black pores, running along the proximal ends of the interneural spines. The dorsal fin begins nearly above the root of the pectoral, but some rudimentary rays are more advanced and hidden under the skin. The rays are moderately long, longer than those of the anal fin, and gradually decrease in length as they approach the end of the tail; in one specimen the small caudal is distinctly free from the other fins. Pectorals with broad bases, and rounded edges, the longest rays two fifths as long as the head. Ventral filaments about half the length of their distance from the vent. The entire fish is either black or of a reddish white colour, with the exception of the jaws and abdomen, which like the buccal and branchial cavities, are deep black. Length 325 mm. (After Günther, not seen by me).

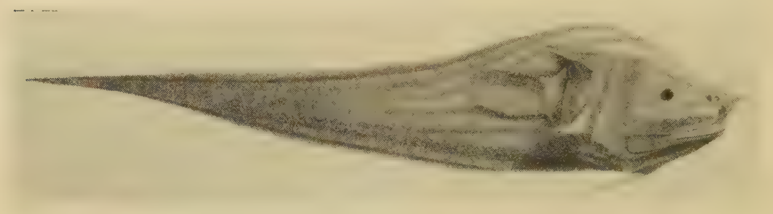

Fig. 64. *Acanthonus armatus* Gthr. After Günther.

Habitat: North of New Guinea, 1926 M. — Philippine Islands, 1890 M.

6. **Glyptophidium** Alcock

(Alcock, Ann. Mag. Nat. Hist. (6) IV, 1889, p. 390)

Head large, body compressed, with a long tapering tail. Head, body, and tail scaled, the scales thin and very deciduous, especially on the head. Bones of the head soft and cavernous, with prominent frill-like outstanding crests. No barbels. Mouth large, oblique. Gill membranes free from each other and from isthmus. Gill rakers well developed. Opercular spine feeble. Two or three short spines near angle of preopercle. Lateral line undistinguishable. Dorsal and anal long, confluent with caudal. Ventrals simple filaments. Branchiostegals 8. Pseudobranchiae present, but rather poorly developed.

Distribution. Six species from deeper parts of Indic and West Pacific.

Key to the Indo-Australian species of Glyptophidium

a. Eye 4-5.66. Distance of origin of D. from tip of snout 5.8-6 in length with caudal. Gill rakers 4 + (13-15) . . 1. *G. argenteum* p. 411.
b. Eye 3. Distance of origin of D. from tip of snout 5 in length with caudal. Gill rakers 5 + 20 . . . . 2. *G. lucidum* p. 412.

1. **Glyptophidium argenteum** Alc.

Glyptophidium argenteum Alcock, Ann. Mag. Nat. Hist. (6) IV, 1889, p. 390. — Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 93.
Glyptophidium argenteum Brauer, Wiss. Erg. Valdivia XXV, Die Tiefsee-Fische, 1. Teil 1906, p. 303.
Glyptophidium argenteum M. Weber, Siboga Exp. Fische, 1913, p. 552.

D. about 120. A. about 100. P. 20. V. 1.

Height 5.92-6.3 in length with caudal. Head 4.87-5.8 in length with caudal. Eye 4-5.66, 1.2-1.6 in snout, and 1.2-1.3 in the interorbital space, which is somewhat convex on account of the median bony ridge, which forms a longitudinal crest. Mouth rather strongly oblique. Lower jaw included. Maxillary reaching to below hind-border of eye or not so far. Band of teeth on upper jaw broader than that on lower jaw; on vomer in a ∧-shaped patch, and on palatines in a long and narrow band. 13-15 slender gill rakers on lower branch of first arch, and 4 somewhat shorter ones on upper branch. Opercular spine weak, preopercular spines poorly developed. Distance of origin of dorsal from snout 5.8-6 in length with caudal. Distance of origin of anal from snout 2.95-3.1 in length with caudal. Dorsal and anal rays decreasing in height posteriorly, the longest dorsal rays equal to snout, the anal rays shorter. Pectorals as long as head without snout. Ventrals about as long as pectorals.

Scales rather large, very deciduous, about 22 between origin of anal and dorsal. Colour of preserved specimens yellowish brown, densely powdered with dusky. Head, base of dorsal, and belly darker. Length 290 mm.

Habitat: Near West Coast of Sumatra, 646 M; Makassar Strait, 734 M, on a bottom of grey mud!; Near Kei Islands, 560 M, on a bottom of fine mud. — Andaman Sea, 487-729 M, off Travancore Coast, 648-830 M.

2. **Glyptophidium lucidum** Sm. & Radcl. (Fig. 65, p. 413)

Glyptophidium lucidum Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 161.

D. 118. C. 11. A. 100. P. 24. V. 1.

Height 5.75 in length with caudal. Head 4.95 in length with caudal. Eye 3, elliptical oval. Snout 4.04 in head, 1.36 in eye, 1.24 in flattened interorbital space. Mouth large, oblique. Lower jaw included. Maxillary barely reaching vertical from posterior margin of eye. Bands of small villiform teeth on jaws, vomer, and palatines; vomerine patch ∩-shaped. Opercle armed with a weak spine. Preopercle with 2 small spines near angle. Gill rakers 5 + 20, the longest less than 0.33 diameter of eye. Scales small, cycloid, more persistent than in *G. argenteum*. Distance of origin of dorsal from tip of snout 5 in length with caudal; distance of origin of anal from tip of snout 2.95 in length with caudal. Anal rays shorter than dorsal rays. Ventrals 1.72, longer than in *argenteum*, each composed of a single filament, bases close together in advance of vertical from insertion of dorsal. Pectoral 1.5. Colour in alcohol: Body ochraceous buff, with silvery glints and dusky punctulations (much lighter than in *argenteum*); head and belly cream buff, a dusky brown area at base of dorsal, dusky coloration most distinct on the base of each ray. Fins light grey, more or less translucent. Length 230 mm. (After Smith & Radcliffe, not seen by me).

Habitat: Near Halmahera, at a depth of 314 M, on a bottom of grey mud and fine sand; Palawan Passage.

7. **Lamprogrammus** Alcock

(Alcock, Ann. Mag. Nat. Hist. (6) VIII, 1891, p. 32)

Body compressed, elongate; tail long, tapering to a lash-like filament. Head compressed, with soft almost membraneceous, frilled and crested bones; both head and body covered with thin deciduous scales. Lateral line broad, generally very conspicuous, continued at least half way along the tail; its scales much enlarged, each being furnished with a (luminous) gland. Snout not overhanging the jaws, without barbels. Mouth wide. Villiform teeth in bands on the jaws and palatines and in a Λ-shaped band on the vomer. Gill openings wide. Gill membranes free from each other and from isthmus. Gill rakers well developed. Opercle with a feeble flat spine. Angle of preopercle with or without weak flat teeth. Branchiostegals 8. No pseudobranchiae. Dorsal and anal long, confluent with caudal. No ventral fins.

Distribution. Four deep sea species from the Indic and the Pacific.

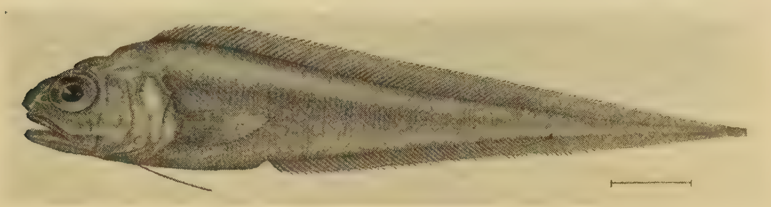

Fig. 65. *Glyptophidium lucidum* Smith & Radcliffe. After Radcliffe.

Key to the Indo-Australian species of Lamprogrammus

a. Maxillary reaching to below middle of eye. Lateral line as wide as eye. Sixteen pectoral rays . . . . 1. *L. niger* p. 413.
b. Maxillary reaching nearly an eye diameter beyond vertical from posterior margin of eye. Lateral line inconspicuous, not as wide as eye. Twenty one pectoral rays . . . . . 2. *L. macropterus* p. 414.

1. **Lamprogrammus niger** Alc.

Lamprogrammus niger Alcock, Ann. Mag. Nat. Hist. (6) VIII, 1891, p. 33. Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 95.
Lamprogrammus niger Brauer, Wiss. Erg. Valdivia XXV, Tiefsee-Fische, 1906, p. 308.
Lamprogrammus niger M. Weber, Siboga Exp. Fische, 1913, p. 556.

D. about 110. A. 92. P. 16.

Height 6.35 in length with caudal. Head 5. Eye small, 7.5, 2 in snout, and 2.25 in somewhat convex interorbital space. Mouth large. Lower jaw included. Maxillary reaching to below middle of eye. Villiform band of teeth on upper jaw broader than that on lower jaw. A narrow ∧-shaped patch on vomer, and long narrow bands on palatines. Twelve gill rakers on lower branch of first arch, the seven ones nearest to angle rather long and slender, the five anterior ones much smaller. Five rather long and slender gill rakers on upper branch and a few rudimentary ones near its upper end. Opercular spine slender, pointed. Two small spines near angle of preopercle. Distance of origin of dorsal from tip of snout 3.09 in length with caudal; distance of origin of anal from tip of snout 2.9. Dorsal deeper than anal. Pectorals short, about half length of head. About 19 scales between origin of anal and lateral line, and one scale between dorsal and lateral line, lastnamed running close to the dorsal profile. The height of the scales of the lateral line equals that of the eye. Colour of preserved specimen, which has lost most of its scales, dark brown, the scale pouches black. Head and belly black. Length 510 mm.

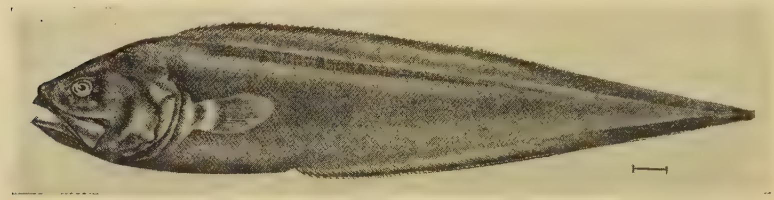

Fig. 66. *Lamprogrammus macropterus* Smith & Radcliffe. After Radcliffe.

Habitat: Near West Coast of Sumatra, 903 M, on a bottom of coral sand; Timor Sea, 828 M, on a bottom of grey clay! — Andaman Sea, 1009-1024 M, Maldive area, 797 M, Coast of East Africa, 914-1134 M.

2. **Lamprogrammus macropterus** Sm. & Radcl. (Fig. 66, p. 414)

Lamprogrammus macropterus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 163.

D. 120. A. 103. C. 9. P. 21.

Height 5.28 in length with caudal. Head 5.05. Eye 7.3, 2.03 in snout, and 2.1 in convex interorbital space. Mouth large, oblique.

Maxillary reaching nearly an eye diameter beyond vertical from posterior margin of eye. Villiform band of teeth on upper jaw broader than on lower jaw. Vomerine patch $\wedge$-shaped, broader than in *niger*. Opercular spine thin, flat, all except the top concealed by skin. Preopercle with a slight emargination near angle. Gill rakers 3 + 15, well developed, flattened, longest nearly equal to diameter of eye. Distance of origin of dorsal from tip of snout 4.78 in length with caudal. Distance of origin of anal from tip of snout 2.66 in length with caudal. Pectorals 1.72 in head. Lateral line inconspicuous, not as wide as eye, the inner plate-like scales much less distinct than in other described forms and the band of small scales covering plates more nearly equal in size to those above and below. Colour in alcohol clove brown, fins and branchiostegal membranes somewhat darker. Inside of gill covers and peritoneum dark seal brown. Length 545 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Buton Strait, at a depth of 1006 M, on a bottom of green mud.

8. **Neobythites** Goode & Bean

(Goode & Bean, Proc. U. S. Nat. Mus. VIII, 1886, p. 600)

Watasea Jordan & Snyder, Proc. U. S. Nat. Mus. XXIII, 1901, p. 765.

Elongate, tail tapering. Head, body and tail covered with small scales. Lateral line ending on tail at some distance of caudal. Eye moderate. Snout short, rounded, slightly or not produced. No barbels. Mouth rather wide. Teeth in villiform bands on jaws, vomer, and palatines. A spine at the angle of the opercle and two weak spines at angle of preopercle present or absent. Gill openings wide. Gill membranes free from isthmus and from each other. Gill rakers well developed. Branchiostegals 8. Pseudobranchiae present, but small. Dorsal and anal long, more or less confluent with caudal. Each ventral fin consisting of two rays which are separate in all or part of their extent.

Distribution: About a dozen deep sea species from the Atlantic, Indic, and Pacific.

Key to the Indo-Australian species of Neobythites

A. Ventrals more than twice as long as
head . . . . 1. *N. longiceps* p. 416.
B. Ventrals shorter than head . . . . 2. *N. steatiticus* p. 417.

1. **Neobythites longipes** Sm. & Radcl.

Neobythites longipes Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 139.

D. 95. A. 80. P. 26. V. 2.

Height 5.05, 5.44 in length with caudal. Head 4.25, 4.58 in length with caudal. Eye 5.08, elliptical oval. Snout 4, long, pointed, not projecting beyond mouth. Mouth large, oblique. Lips thin, upper jaw overhanging lower. Maxillary reaching beyond vertical from posterior margin of eye for slightly less than a half diameter of eye. Teeth small, blunt, in bands on jaws, on vomer in a ∩-shaped patch, on palatines, and on tongue. Interorbital space slightly convex, 4.85 in head. Nostrils widely separated, the anterior circular, with a raised border, near edge of snout, posterior near eye. Opercle armed with a single sharp spine, a short flat spinule at angle of preopercle. Gill rakers 4 + 7, the longest slightly less than a half diameter of eye. A ring of long finger-like pyloric coeca around the pylorus, and a short series along each side of the neighbouring part of the gut. Ten scales in a series from origin of dorsal to and including lateral line. Vertical fins scaled nearly to margin. Lateral line in upper third of body, disappearing at a point about 0.4 length of head from base of caudal. Distance of origin of dorsal from tip of snout 3.73, 4.03 in length with caudal. Distance of origin of anal from tip of snout 2.07, 4.03 in length with caudal. Distance of origin of anal from lower pectoral base equal to length of head. Ventrals bifid, bases well separated, inserted slightly behind symphysis of cleithra, inner ray longest, more than twice as long as head. Pectorals acutely rounded, 1.7 in head. Colour in alcohol raw sienna, becoming pearly gray on belly. Sides and ventral surface of head and body finely punctulate with darker, traces of a brownish band extending from tip of snout through middle of eye to tip of opercular spine. Ground colour of dorsal dusky gray, a

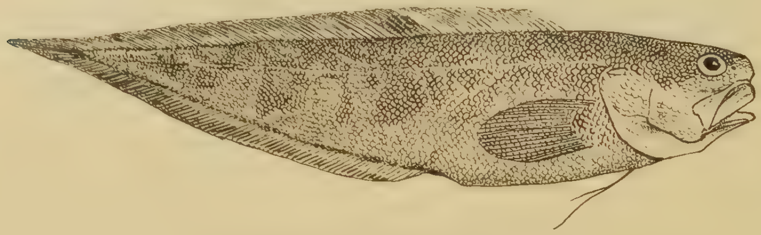

Fig. 67. *Neobythites steatiticus* Alc.

large black ocellus margined with lighter lies between the twenty first and thirty second rays; behind this is a median band of dusky black, widening posteriorly until it covers nearly the entire fin. Upper rays of caudal dusky gray, distal two thirds of lower rays black. Anterior half of anal gray, punctulate with darker, colour changing to black on posterior rays, the black coloration not extending to base of rays. Paired fins grayish, finely punctulate with darker. Peritoneum very dark brown. Length 302 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Daniel Bay, Borneo; near Jolo, at a depth of 464 M, on a bottom of fine sand and shells.

2. **Neobythites steatiticus** Alc. (Fig. 67, p. 416)

Neobythites steatiticus Alcock, Journ. Asiat. Soc. Bengal LXII, 1893, p. 181. — Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 82.
Neobythites (Watasea) unimaculatus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 140.
Neobythites malayanus M. Weber, Siboga Exp. Fische, 1913, p. 554.
Neobythites steatiticus Norman, John Murray Exp. Sc. Rep. VII, N° 1, 1939, p. 76.

D. about 87-95. A. about 73-80. P. 27. V. 2.

Height 4.5-4.7, 4.9-5 in length with caudal. Head 4.1-4.2, 4.4-4.5 in length with caudal. Eye 4.5-4.8, equal to or somewhat more than snout and slightly more than somewhat convex interorbital space. Mouth oblique. Maxillary reaching somewhat beyond vertical through hindborder of eye. Bands of teeth on jaws, vomer, and palatines narrow, those on vomer in a Λ-shaped patch. Gill rakers 4 + 6, plus some rudimentary ones at the distal ends of both upper and lower branches of the first arch. Opercular spine strong. A weak spine at angle of preopercle, not always distinct. Sometimes a second still weaker spine above the first. Origin of dorsal behind that of pectoral, its distance from tip of snout 3.7-3.8, 4-4.1 in length with caudal. Distance of origin of anal from tip of snout 2.2-2.3, 2.3-2.5 in length with caudal. Distance between origin of anal and base of pectoral less than half length of snout shorter than head. Anterior and median dorsal rays somewhat more than eye, posterior rays longer, slightly less than eye and snout. Anal somewhat less deep than dorsal. Pectorals pointed, half diameter of eye longer than postorbital part of head. The two ventral rays adnate for their basal half, the inner ray the longer and equal to postorbital part of head. Scales not deciduous, cycloid, small. Ten or eleven scales between origin of dorsal and lateral line. Posterior end of lateral line on tail, at a distance less than length of head from base of caudal. Colour of preserved specimens light brown, back and sides marbled with darker brown, belly greyish silvery, the dark peritoneum shining through the body wall. Branchiostegal membranes and inside of mouth unpigmented. Dorsal dusky, with brown cloudings, forming more or less distinct longitudinal bands on posterior part of fin. A large oval black blotch, beginning on 20th ray of dorsal or somewhat more forward, and extending for about 6 rays. Anterior part of anal whitish, from the 10th ray backward the fin is dark brown with a narrow terminal light edge. Caudal dark brown. Pectorals greyish, light at tip. Ventrals light. Length 210 mm.

Habitat: Saleh Bay, Sumbawa, 274 M, fine sandy mud!; near Mabul Island, Borneo, 558 M, green mud and sand. — Zanzibar area, 238-293 M, Gulf of Aden, 186-549 M, Sea of Oman, Bay of Bengal, 192-270 M.

Note. My description is made after the specimens described as *malayanus* by M. Weber. I do not think that they differ from *steatiticus* or from *unimaculatus*. The chief difference between these three is that *steatiticus* has no preopercular spines, *malayanus* has one, and *unimaculatus* two (one at angle and another above it). I find, however, in the specimens of *malayanus* some with one, others with none, and one with two spines at one side, arranged as in *unimaculatus*. According to the descriptions the three species also differ in the distance between the origin of the anal and the base of the pectoral. This distance equals the postorbital part of the head in *steatiticus*, it is four sevenths of the length of the head in *unimaculatus*, what almost amounts to the same length, but it almost equals the length of the head in *malayanus*. As the said difference may be measured in different ways, viz. from the axil (as I did) or from the base of the fin rays, I don't lay much stress on this characteristic. Norman l.c. is apparently also of the opinion, that *steatiticus* and *malayanus* are the same, as he includes the Indo-Australian Archipelago in the distribution of *steatiticus*, and on p. 84, where a list of the known species is given, *malayanus* is not mentioned. Norman, however, records *unimaculatus* as a distinct species.

9. **Monomitopus** Alcock

(Alcock, Ann. Mag. Nat. Hist. (6) VI, 1890, p. 297)

Elongate, tail tapering. Head, body and tail covered with small, very deciduous scales. Bones of the head rather weak, cavernous. Lateral line ending at some distance of caudal. Eye moderate. Snout short, rounded, slightly produced. No barbels. Mouth rather wide. Teeth in villiform bands on jaws, vomer and palatines. A spine at the angle of the opercle; two or three weak spines at angle of preopercle. Gill openings wide. Gill membranes free from each other and from isthmus. Gill rakers well developed. Branchiostegals 8. No pseudobranchiae. Dorsal and anal long, more or less confluent with caudal. Ventrals reduced, each consisting of a single ray, inserted close together just behind symphysis of cleithra.

Distribution: About 9 deep-sea species from the Atlantic. Indic and Pacific.

1. **Monomitopus conjugator** (Alc.) (Fig. 68, p. 420)

Neobythites conjugator Alcock, Journ. Asiat. Soc. Bengal LXV, 1896, p. 304. — Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 81.
Neobythites conjugator M. Weber, Siboga Exp. Fische, 1913, p. 555.
Monomitopus pallidus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 148.
Monomitopus conjugator Norman, John Murray Exp. Sc. Rep. VII, N° 1, 1939, p. 85.

D. about 85. A. about 66. P. 28. V. I.

Height 4.5-5.2, 5-5.6 in length with caudal. Head 3.88-4.32, 4.2-4.6 in length with caudal. Eye 4.1-4.5, equal to or somewhat more than snout, 1.1-1.3 in convex interorbital space. Mouth somewhat oblique. Maxillary reaching slightly beyond vertical through hind-border of eye. Teeth on vomer in a rather narrow ʌ-shaped band: those on palatines in a much broader band. Opercular spine rather strong, pungent. Two flexible flat spines at angle of preopercle. Origin of dorsal slightly behind base of pectoral, its distance from tip of snout 3.7-3.9, 4-4.2 in length with caudal. Distance of origin of anal from base of pectoral equal to head or half length of snout shorter, and from end of snout 2.1-2.4, 2.3-2.6 in length with caudal. Ventrals equal to head without snout. Colour of preserved specimens brownish or yellowish, belly darker, the black peritoneum shining through. Scale pouches black. Vertical fins black. Length 225 mm.

Habitat: Sulu Sea, 1270 M, Globigerina ooze!; Celebes Sea, 1301 M, fine grey ooze!; Flores Sea, 794 M, fine grey ooze!; Ceram Sea, 835 M, blue clay! — Philippines, Globigerina ooze, 780 M, off Porto Novo, off Travancore Coast, 740-1015 M.

Note. M. Weber l.c. says that two of his specimens (St. 45, Siboga Exp.) had only 50 dorsal rays. Here some mistake has been made, for on recounting the rays I find 85 dorsal rays in both specimens.

10. **Monomeropus** Garman

(Garman, Mem. Mus. Comp. Zool. XXIV, 1899, p. 158)

Body elongate, compressed, covered with small, cycloid, deciduous scales. Head also scaly. Lateral line terminating at middle of body. Head without barbels. Skin of head thin, covered with small scales, plainly showing the mucous chambers in the skull beneath it. Mouth large, oblique. Villiform teeth on jaws, vomer, and present or absent on palatines. Opercle with a single spine. Two or three short preopercular spines. Dorsal and anal confluent with caudal. Pectorals moderate. Ventrals consisting of a single ray, close together, immediately behind symphysis of cleithra. Caudal pointed. Pseudobranchiae very small. Gill laminae very short. Branchiostegals 8. Gill rakers well developed. Gill membranes not united, free from isthmus. A ring of 5 rudimentary appendages round the pylorus.

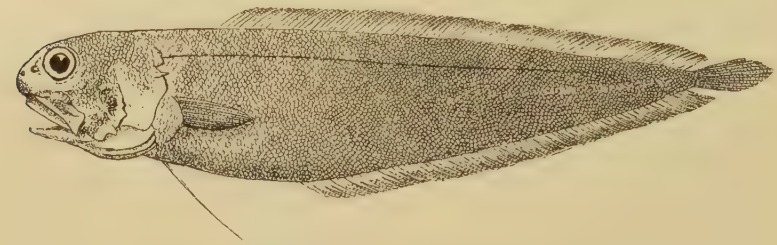

Fig. 68. *Monomitopus conjugator* (Alc.) × ²/₃.

Distribution. Two deep sea species from the East Pacific and from the Gulf of Tomini.

1. **Monomeropus garmani** Sm. & Radcl. (Fig. 69, p. 421)

Monomeropus garmani Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 151.

D. 96. A. 80. P. 31. V. 1.

Height 5.52, 5.85 in length with caudal. Head 4.91, 5.2 in length with caudal. Eye 5.3. Snout 4.08 in head, as broad as long, very slightly overhanging mouth. Interorbital space broad, convex, 3.21 in head. Upper jaw overhanging lower. Maxillary reaching beyond vertical from posterior margin of eye for about 0.7 an eye diameter. Teeth small, villiform; head of vomer prominent, knob-like, covered with teeth, a narrow short series on each side extending backward nearly to palatines. Scales small, covering head and body, and forming a sheath along base of dorsal and anal. Seven or eight scales in a series from origin of dorsal to and including lateral line, 25 from origin of anal to lateral line. Distance of dorsal from tip of snout 4.13, 4.37 in length with caudal. Distance of anal from tip of snout 2.57, 2.72 in length with caudal. Ventrals short, broken in the single specimen known. Pectorals 1.83, broad, scaled at base. Colour in alcohol clove brown. Opercular region blackish. Fins somewhat darker. Peritoneum seal brown. Length 275 mm. (After Smith and Radcliffe, not seen by me).

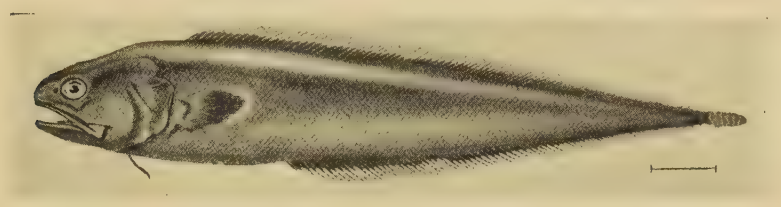

Fig. 69. *Monomeropus garmani* Smith & Radcliffe. After Radcliffe.

Habitat: Gulf of Tomini, Celebes, at a depth of 1220 M.

11. **Dicrolene** Goode & Bean

(Goode & Bean, Bull. Mus. Comp. Zool. X, 1883, p. 202)

Pteroidonus Günther, Rep. Sc. Results Challenger. Zool. XXII, 1887, p. 106.
Paradicrolene Alcock, Ann. Mag. Nat. Hist. (6) IV, 1889, p. 387.

Body and tail compressed, covered with small cycloid scales. Head less compressed, also scaled. Lateral line close to the base of the dorsal, incomplete. Head without barbels. Bones of the head somewhat cavernous. Mouth large. Villiform bands of teeth on jaws, vomer, and palatines. Opercle with a strong, sharp spine. Margin of preopercle usually with 3 small, strong spines. Dorsal and anal not quite confluent with caudal, but caudal peduncle absent. Pectoral rays arranged in two groups, several of the lower ones being free or partially connected by membrane, and prolonged. Ventrals consisting of 2 rays which are totally adnate or only at base. Gill membranes free from each other and from isthmus. Branchiostegals 8. Gill rakers well developed. Pseudobranchiae rudimentary. Pyloric coeca few, rudimentary.

Distribution. Eleven deep sea species from the Atlantic, Indic, and Pacific.

Key to the Indo-Australian species of Dicrolene

A. Pectorals 18 + (8 + 10).
  a. 11 gill rakers on lower branch of first arch . . . . 1. *D. multifilis* p. 422.
  b. 20 gill rakers on lower branch of first arch . . . . 2. *D. tristis* p. 423.
B. Pectorals 17 + 5 . . . . 3. *D. hubrechti* p. 423.

1. **Dicrolene multifilis** (Alc.)

Paradicrolene multiflis Alcock, Ann. Mag. Nat. Hist. (6) IV, 1889, p. 387.
Dicrolene multifilis Alcock, Descr. Cat. Indian Deep-Sea Fishes, 1899, p. 86.
Dicrolene multifilis M. Weber, Siboga Exp. Fische, 1913, p. 553.

D. about 100. A. about 85. P. 18 + (8 + 10). V. 2.

Heigth 6.5, 7.1 in length with caudal. Head 5.7, 6.3 in length with caudal. Eye 3.4, about equal to interorbital space. Snout 4.8 in head, not overhanging the mouth. Mouth somewhat oblique. Lower jaw included. Maxillary reaching to below frontborder of eye or somewhat further. Rather narrow bands of teeth on the jaws, in a ∧-shaped patch on vomer, and in narrow bands on palatines. Opercular spine somewhat directed outwards. Preopercular spines short but strong. Eleven slender gill rakers on lower branch of first arch, and some rudimentary ones on the upper arch. Origin of dorsal to tip of snout 4, 4.4 in length with caudal. Origin of anal to tip of snout 2.55, 2.8 in length with caudal. Median dorsal rays slightly longer than the others, somewhat longer than eye. Anal rays shorter. Upper part of pectoral as long as head without snout, the detached rays longer, at least the upper ones. Ventrals consisting of 2 rays which are adnate for their basal fourths. About 33 scales between origin of anal and dorsal. Lateral line indistinct. Colour of preserved specimen: Head greyish, body and tail yellowish brown, belly blackish, the dark peritoneum shining through the skin. Length 187 mm.

Habitat: Flores Sea, 694 M, on a bottom of fine grey mud! — Bay of Bengal, 247-305 M, Andaman Sea, 487 M, Zanzibar area, 640-658 M.

2. **Dicrolene tristis** Sm. & Radcl.

Dicrolene tristis Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 145.

D. 103. C. 6. A. 80. P. 18 + 10. V. 2.

Height 5.83, 6.38 in length with caudal. Head 4.85, 5.31 in length with caudal. Eye 4. Snout 3.82, rounded. Mouth large, oblique, upper jaw overhanging lower. Maxillary extending beyond vertical from posterior margin of eye for 0.33 an eye diameter. Teeth small, villiform, the patch on vomer broadly ∩-shaped. Interorbital space 3.43, broad, flattened. Opercle armed with a single strong, sharp spine. Angle of preopercle armed with 3 small, sharp, spines. Gill rakers 5 + 20, the longest nearly 0.75 as long as eye. Scales small, cycloid, deciduous, covering head and body, and forming a low sheath at base of dorsal and anal. Eight scales in a series from origin of dorsal to and including lateral line, about 25 from origin of anal to lateral line. Lateral line broad, distinct anteriorly, disappearing at about a head's length from base of caudal. Distance of dorsal from tip of snout 4, 4.1 in length with caudal. Distance of anal from tip of snout 2.43, 2.66 in length with caudal. Ventrals small, rather widely separated at base, each consisting of 2 rays, united by membrane for a very short distance at base, inner rays longest, 2.23 in head. Upper pectoral rays united, the longest about equal to head. Lower rays separate, filamentous, 1.5 times as long as head. Colour in alcohol tawny olive. Opercular region, branchiostegals, and fins dark clove brown. Peritoneum dark chestnut brown. Length 255 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Borneo (Sibuko Bay); Celebes. — Philippines, at a depth of 864 M, on a bottom of grey mud.

Note. This species is possibly not different from *D. multifilis*.

3. **Dicrolene hubrechti** M. Web. (Fig. 70, p. 424)

Dicrolene Hubrechti M. Weber, Siboga Exp. Fische, 1913, p. 553.

D. 91. A. 75. P. 17 + 5. V. 2.

Height 7.1, 7.7 in length with caudal. Head 4.61, 4.95 in length with caudal. Eye 6.3, elliptical, covered by skin, 1.5 in snout and in flat interorbital space. Snout 4 in head. Mouth large, somewhat oblique. Maxillary reaching one eye diameter beyond vertical from posterior margin of eye. Villiform bands of teeth in the jaws. Teeth on vomer in a ∩-shaped patch, the posterior ends diverging. Teeth on palatines in a long, narrow band, incurved at its anterior end. Opercle with a strong spine, in the single specimen known bifid at the right side. Preopercle with three equidistant spines. Seven slender gill rakers on lower branch of first arch, two very short ones on the upper branch. Distance of dorsal from tip of snout 3.92, 4.22 in length with caudal. Distance of anal from tip of snout 2.36, 2.54 in length with caudal. Dorsal and anal increasing in height posteriorly, the longest dorsal rays somewhat more than length of snout, the longest anal rays somewhat shorter. The upper part of the pectoral is as long as the head without snout, the lower part is composed of 5 detached rays, the upper one of which is the longest, reaching far on anal. Ventrals rather widely separated, consisting of 2 articulated and united rays, the inner one the longer and 3.9 in head. Scales elongate, cycloid. About 33 scales between origin of anal and dorsal. Lateral line reaching to below end of first fourth of length of dorsal. Colour of preserved specimen yellowish. Dorsal and anal with brown terminal, longitudinal bands which are darker and broader posteriorly. Caudal also dark brown. Distal half of upper part of pectoral brown. Length 300 mm.

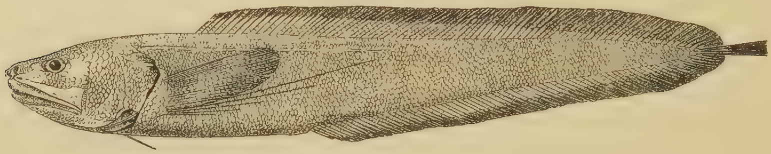

Fig. 70. *Dicrolene hubrechti* M. Web. × 1/3.

Habitat: Timor Sea, at a depth of 918 M, on a bottom of grey mud.

12. **Barathrodemus** Goode & Bean

(Goode & Bean, Bull. Mus. Comp. Zool. X, 1883, p. 200)

Much compressed, elevated. Head considerably compressed, with the mouth moderate. Head spineless, except a short flattened spine at the upper angle of the opercle. Snout long, projecting far beyond the tip of the upper jaw, its extremity much swollen. Jaws nearly equal in front. Teeth minute, in villiform bands on jaws, vomer, and palatines. No barbels. Anterior pair of nostrils open and situated at the outer angles of the dilated snout, circular, each surrounded with a cluster of mucous tubes. Posterior nostrils near anterior upper margin of orbit. Gill openings wide, membranes not united. Gills 4, with a slit behind the fourth. Gill laminae short or moderate in length. Gill rakers also moderate. Pseudobranciae absent or rudimentary. Caudal incompletely united with dorsal and anal, which are long. Branchiostegals 8. Body and head covered with small, thin, cycloid scales, those on the body scarcely imbricated. Lateral line absent. Ventrals a pair of bifid rays close together, on the isthmus.

Distribution. A few species from the deeper parts of Atlantic and Indo-Pacific.

1. **Barathrodemus nasutus** Sm. & Radcl. (Fig. 71, p. 426)

Barathrodemus nasutus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 152.

D. 99. A. 81. C. 9. P. 24. V. 2.

Head 4.78, 5.38 in length with caudal, fleshy covering entirely concealing bony structure; body short, deep, so thin that the interneurals and interhaemals are descernible, strongly arched, greatest depth 4.25, 4.77 in length with caudal. Eye 6.4, small, elliptical oval; snout 4, much produced and dilated, overhanging mouth; mouth small, inferior, nearly horizontal, upper jaw overhanging lower; maxillary 2.28, short, almost entirely concealed by suborbital, posterior end dilated, truncate, extending beyond vertical from posterior margin of eye for 0.8 an eye diameter. Teeth small, villiform; patch on vomer broadly ∧-shaped. Opercle armed with a single slender, sharp spine, almost entirely concealed by skin. Preopercle unarmed, the fleshy skin covering both it and opercle continuous. Gill rakers 4 + 19, those on upper arch and near end of lower arch reduced to small protuberances, the longest about 0.63 diameter of eye. Scales forming a scaly sheath at base of dorsal and anal. About 39 scales in a series from origin of anal to dorsal. Dorsal and anal continuous with the caudal. Distance of tip of snout to dorsal 4.5, to anal 2.64 in length without caudal. Ventrals 2.6 in head. Pectorals narrow, pointed, twice as long as ventrals. Colour in alcohol: Body sepia, sides, ventral surface of head, belly, and fins, slightly darker; peritoneum dark seal brown. Length 172 mm. (After Smith & Radcliffe, not seen by me).

Habitat: Gulf of Tomini, at a depth of 1960-1965 M, on a bottom of green mud.

13. **Bassogigas** Goode & Bean

(Goode & Bean (ex Gill MS.) Oceanic Ichthyol. 1896, p. 328.)

Body elongate, compressed, covered with thick heavy skin, which upon the head covers and obscures all the angles of the skull. Scales small, covering body and head completely. Lateral line indistinct for the greater part of its course, sometimes indistinguishable, except for traces of a few rudimentary pores on head. Eye moderate. Vertical fins completely united. Ventrals a pair of bifid filaments inserted behind the symphysis of the cleithra, and remote at their bases, short, rather stout. Snout without barbels, slightly produced, the lower jaw being barely included. Villiform teeth on the jaws, on the vomer, and the palatines. Opercle with a long, sharp spine, preopercle unarmed. Branchiostegals 8. Pseudobranchiae small. No pyloric appendages.

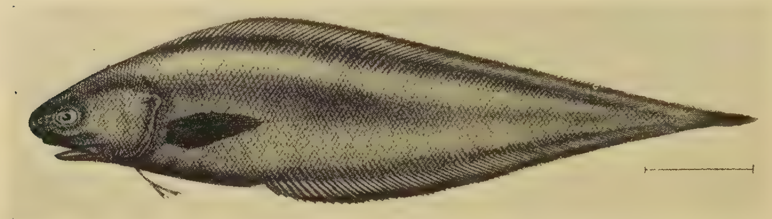

Fig. 71. *Barathrodemus nasutus* Smith & Radcliffe. After Radcliffe.

Distribution. Seven deep sea species are known from the Atlantic, Indic, and Pacific.

1. **Bassogigas aequatoris** Sm. & Radcl. (Fig. 72, p. 427)

Bassogigas aequatoris Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 153.

D. 104. A. 87. P. 19. V. 2.

Head 5.06, 5.65 in length with caudal, bluntly rounded anteriorly, arched posteriorly. Height 6.07, 6.78 in length with caudal. Eye 6.8, snout 3.78 in head, scarcely projecting beyond mouth. Mouth of moderate size, subterminal, nearly horizontal. Lower jaw included. Maxillary 1.96 in head, reaching an eye diameter beyond vertical from posterior margin of eye, posterior end dilated, truncate. Teeth small, villiform, the patch on vomer broadly ∧-shaped. Opercle armed with a single long, sharp pointed spine. Preopercle unarmed. Gill filaments short. Gill rakers 4 + 15, short, those on outer ends of arch reduced to small protuberances. Scales small, cycloid, persistent, entirely covering head and body. Fleshy bases of dorsal and anal covered with scales. About 32 scales in a series from origin of anal to dorsal. Distance of dorsal from tip of snout 4.3 in length, distance of anal from tip of snout 2.45 in length. Ventrals short, widely separated at base, each consisting of 2 superimposed divided rays, spatulate at tip, the upper ray longest, 2.55 in head. Pectorals narrow, pointed, elongate, 4.16 in length, tips reaching beyond base of anal. Distance from base of lower pectoral rays to anal slightly greater than length of head. Colour in alcohol:

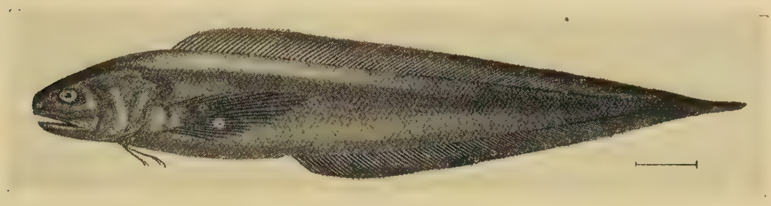

Fig. 72. *Bassogigas aequatoris* Smith & Radcliffe. After Radcliffe.

Body burnt umber; head and belly with greyish cast. Fins and peritoneum dark seal brown. Length 288 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Gulf of Tomini, 1960 M.

14. **Eretmichthys** Garman

(Garman, Mem. Comp. Zool. XXIV, 1899, p. 164)

Body elongate, compressed, covered with small deciduous scales. Lateral line indistinguishable. Head scaled, higher than wide, convex on the crown, broad at snout. Snout blunt, not projecting beyond the mouth. Bones of skull thin, with large mucous cavities, prominent in the internarial region. Mouth large. Teeth small, in villiform bands on jaws, vomer, and palatines. Branchiostegals 8. Nostrils rather close together, prominent; a groove from the anterior nostril down and forward to the lip. Eye small, lateral. Gill openings wide. Gill membranes not united, free from isthmus. Four gills, a slit behind the fourth. Gill rakers numerous, elongate, slender.

Pseudobranchiae small. No barbels. Opercles thin, margins flexible. Preopercle not armed, expanded posteriorly to form a broad, rounded lobe. Vertical fins united. Ventrals of a single filamentary ray, close together behind the symphysis of the cleithra. Pectorals broad, the lower half of the fins produced, rigid, oar-like. Caudal pointed.

Distribution. Two or three species from deep water of the East Pacific, and the Gulf of Tomini.

1. **Eretmichthys remifer** Sm. & Radcl. (Fig. 73, p. 429)

Eretmichthys remifer Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 155.

D. 124. A. 100. P. 26 (11 + 15). V. 1.

Height 7.46, 8.12 in length with caudal. Head 5.82, 6.32 in length with caudal. Eye 8.6, one third of interorbital space. Snout 3.91 in head, broad, blunt, scarcely projecting beyond mouth. Mouth wide, slightly oblique, the lower jaw included. Maxillary reaching an eye diameter beyond vertical from posterior margin of eye, largely concealed by suborbital. Teeth in villiform bands on jaws, vomer, and palatines. Opercular spine feeble. Preopercle entire, produced backward nearly to posterior margin of opercle. Dorsal origin close to head, its distance from tip of snout 6.58, 7.16 in length with caudal. Caudal narrow, elongate, pointed. Origin of anal a head length behind base of lower pectoral rays, its distance from tip of snout about one third standard length. Ventrals 1.26 in head. Upper 11 pectoral rays shorter than head, lower rays greatly produced, less flexible, bound together and thickened near base, the longest 3.12 in length with caudal. Colour in alcohol: Cinnamom, darker shades on head and belly; fins light olivaceous. Stomach and peritoneum dark chestnut brown. Length 272 mm.(After Smith & Radcliffe, not seen by me).

Habitat: Gulf of Tomini, Celebes, at a depth of 1965 M, on a bottom of green mud.

15. **Alcockia** Goode & Bean

(Goode & Bean, Oceanic Ichthyol. 1896, p. 329)

Body elongate, compressed, covered with small scales, and the head also scaled. No continuous lateral line, though traces can be distinguished at various parts of the body. Bones of the head rather thin, with large, somewhat conspicuous sinuses. Sharp, well developed spines upon opercle and preopercle, which is expanded posteriorly, and has a crenulated margin, behind eye, upon the superciliary crest, and behind the posterior nostril, which is separated from the orbit by a short, spinous projection. Muciferous channels ample, that of the frontal bone opening in front by a wide aperture on each side of the rostral projection, and each mandibulary canal opening in front immediately behind the symphysis by a slit in the skin. The mucous membrane of the nasal cavity in two folds, forming together a longitudinal pad with a linear base. Snout and lower jaw without barbels. Teeth in villiform bands on jaws, vomer, and palatines. Dorsal and anal long, confluent with the caudal. Pectorals narrow and feeble. Ventrals each composed of two filaments, short, very feeble and close together, inserted on isthmus, some distance from symphysis of cleithra. Scales cycloid, persistent, irregular. Gill laminae short. Gill rakers stiff, far apart, and but few in number. Branchiostegals 8. Pseudobranchiae represented by two or three small lobes.

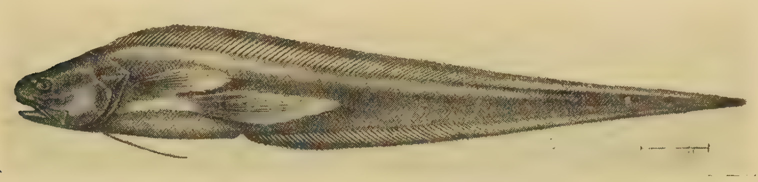

Fig. 73. *Eretmichthys remifer* Smith & Radcliffe. After Radcliffe.

Distribution that of the single species known.

1. **Alcockia rostrata** (Gthr.) (Fig. 74, p. 430)

Porogadus rostratus Günther, Rep. Sc. Results Challenger. Zool. XXII, 1887, p. 113.

D. 120. A. 95?. P. 21. V. 2.

The body is moderately compressed, the head depressed, especially in its rostral portion. The greatest depth of the former is about the middle of the abdomen, and two fifths of the length of the trunk, of which the head forms a little more than one half. The trunk (including the head) is fully two thirds of the length of the tail, which rapidly tapers to a fine point. Head as broad as high, its width being equal to the length of the postorbital portion; snout depressed, with its central portion slightly produced, overlapping the lower jaw. Mouth wide, extending to the hind margin of the orbit. Eye small, immediately below the upper profile, one ninth of the length of the head, one third of that of the snout, and two fifths of the width of the flat interorbital space. Vomerine band of teeth Λ-shaped and much narrower than the palatine band. The dorsal begins above the posterior third of the pectoral, and is composed of densely set, fine and rather short rays, which, however, are a little longer than those of the anal fin. Pectorals not quite half as long as the head; ventral filaments still shorter. About 30 scales in a transverse series running from the vent to the dorsal fin. Uniform black. Length of single specimen known 287 mm. (After Günther, not seen by me).

Habitat: North of Celebes, at a depth of 3870 M.

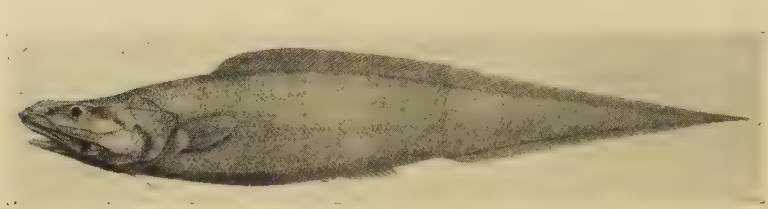

Fig. 74. *Alcockia rostrata* (Gthr.). After Günther.

16. **Bassozetus** Gill

(Gill. Proc. U. S. Nat. Mus. VI, 1883, p. 259)

Bathynectes Günther, Ann. Mag. Nat. Hist. (3) II, 1878, p. 20 (preoccupied).
Bathyonus Goode & Bean, Proc. U. S. Nat. Mus. VIII, 1886, p. 603.

Body elongate, compressed, covered with small, cycloid scales. Head also scaly, excepting the snout. No distinguishable lateral line. Bones of the head very soft and cavernous. Snout hardly overhanging the lower jaw, without barbels. Mouth wide. Villiform teeth in bands on the jaws, vomer, and palatines. Preopercle expanded posteriorly to form a broad, rounded lobe, its edge entire. Opercular spine very feeble, ridge-like. Eye small. The anterior nostrils about midway between the posterior and the extremity of the snout. Dorsal and anal confluent with the caudal. Ventrals close together at base, each a single filament, and inserted below the angle of the preopercle. Pectorals simple. Gill openings wide. Eight branchiostegals. Pseudobranchiae rudimentary or absent. Gill rakers long and stiff.

Distribution. Atlantic and Indo-Pacific, at great depths.

Key to the Indo-Australian species of Bassozetus

1. Height 5.45-5.78.
   - *a.* Tips of ventrals not reaching vent. Scales larger, 16 in a transverse row between origin of anal and dorsal . . . . 1. *B. compressus* p. 431.
   - *b.* Tips of ventrals reaching vent. Scales smaller, 32 in a transverse row between origin of anal and dorsal . . . . 2. *B. robustus* p. 432.
2. Height 7.41 . . . . 3. *B. elongatus* p. 433.

1. **Bassozetus compressus** (Gthr.)

Bathynectes compressus Günther, Ann. Mag. Nat. Hist. (3) II, 1878, p. 20.
Bathyonus compressus Günther, Challenger Rep. Zool. XXII, 1887, p. 109.
Bassozetus compressus Goode & Bean, Oceanic Ichthyol. 1896, p. 322.

D. 116. A. 92. P. 23. V. 1.

Height 5.78, about one half of the length of the trunk, the vent being twice as distant from the extremity of the tail as from the snout. Head compressed like the body, and about two thirds the length of the trunk; the superficial bones form large muciferous cavities which, when full, must give to the head a much more evenly rounded appearance than in the present state, when the supporting bony ridges project more or less from under the skin. The snout is slightly swollen, but the jaws are nearly even in front, the wide mouth slightly ascending forwards. Maxillary dilated behind, and extending behind the eye. Eye very small, one half of the length of the snout, and about one eleventh of that of the head; it is placed high up on the side, and does not possess an orbital fold of the integument. Interorbital space rather convex and equal in width to three diameters of the eye. All the teeth are very small and short, densely set, and form villiform bands. The broadest is that of the upper jaw, and is quite uncovered on the sides, no labial folds being developed. The palatine band is broader than the mandibulary, and the vomerine band ∧-shaped, each arm being bent with the convexity inwards. The gill rakers are much longer than the laminae, fifteen in number on the anterior arch, besides some rudimentary ones above. The dorsal commences above the upper end of the gill opening, with short rays partly hidden in the skin; the rays become longer in the middle of the fin, but remain of moderate length, and the anal rays are still shorter. The pectoral has a rather narrow base, is quite free, and composed of feeble rays; its length is only half that of the head. Ventral rays very feeble, reaching somewhat beyond the root of the pectoral. Only very few of the thin, cycloid scales have been preserved; they are of moderate size, there being about sixteen in a transverse series running from the vent to the dorsal. The lateral line, if it was developed, can no longer be traced. Blackish with the fins, head, and abdomen black. Length 485 mm. (After Günther, not seen by me).

Habitat: South Coast of New Guinea, 2520 M. — Mid-Atlantic, 2700 M.

2. **Bassozetus robustus** Sm. & Radcl. (Fig. 78, p. 433)

Bassozetus robustus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 156.

D. 120. A. 102. P. 25. V. 1.

Height 5.45, 6 in length with caudal. Head 4.67, 5.14 in length with caudal, its depth nearly twice its breadth, about 0.85 its length, large, compressed, depressed anteriorly, strongly arched posteriorly, bones soft and cavernous, a prominent internarial ridge, and a ridge near each side of interorbital space, these slightly diverging posteriorly, separated by a deep concavity, with a smaller concavity lying between ridges and eye (in life these concavities were probably much less distinct), a distinct prominence above and behind each eye. Eye 10, 2.64 in snout, which is somewhat swollen, as broad as interorbital space, not projecting beyond mouth. Mouth large, oblique, lower jaw included. Maxillary dilated behind, extending 2 eye diameters beyond vertical from posterior margin of eye. Teeth small, sharp, in broad bands on jaws, vomer, and palatines; band on vomer broadly ∧-shaped, each arm being bent with the convexity inward. Twelve well developed gill rakers on lower arch. Scales small, deciduous, covering head and body, and fleshy bases of dorsal and anal. About 32 scales in a series from origin of anal to dorsal. Dorsal origin close to head. Origin of anal about 0.66 length of head behind base of lower pectoral rays. Ventrals 1.2 in head, tips reaching to vent, bases close together. Pectorals 1.63 in head. Colour in alcohol: Back and sides of body buff. Belly with dusky black shades. Head grey, blackish underneath. Opercles, branchiostegals, and lips blackish. Fins dusky.

Inside of mouth greyish. Fins dusky, marginal portion of dorsal and anal darker than basal portion. Length 360 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Palawan Passage, 1314 M, on a bottom of coral and sand. — Philippines?

Note. This species is close to *compressus*. The specimen of last named species recorded by Günther from the Philippines, may be *robustus,* as suggested by Smith and Radcliffe, as it has longer ventrals, reaching to the vent.

3. **Bassozetus elongatus** Sm. & Radcl.

Bassozetus elongatus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 157.

D. 118. A. 102. P. 22. V. 1.

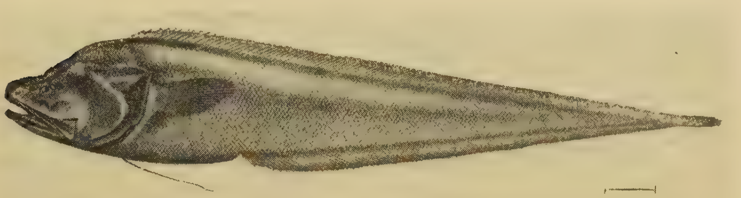

Fig. 75. *Bassozetus robutus* Smith & Radcliffe. After Radcliffe.

Height 7.41, 8 in length with caudal. Head 5.43, 5.86 in length with caudal, its depth less than twice its breadth, about 0.75 its length, compressed, depressed anteriorly, arched posteriorly, bones soft and cavernous. Ridges on head prominent. Eye 12.1, 2.64 in snout. Snout swollen, slightly broader than interorbital space, not projecting beyond mouth. Mouth large, oblique, lower jaw included. Maxillary delated posteriorly, more than twice diameter of eye, extending beyond hindborder of eye. Teeth small, sharp, in broad bands on jaws, vomer, and palatines; band on vomer similar to that in *B. robustus,* except that the head of the vomer projects downward much more strongly. 16 long, well developed gill rakers on lower arch, the longest 1.7 times diameter of eye. Scales large, deciduous, covering head and body, and fleshy bases of dorsal and anal; it is impossible to determine accurately their number, but there appear to have been between 16 and 20 between origin of anal and dorsal. Dorsal origin close to head. Caudal very narrow and elongate. Origin of anal about 0.7 length of head behind bases of lower pectoral rays. Ventrals 1.9 in head, bases close together. Pectorals as long as ventrals. Colour in alcohol: Body hair brown, becoming blackish on belly. Head plumbeous, blackish underneath, darkest on opercles, branchiostegals, and lips. Fins dusky. Inside of mouth greyish. Length 480 mm. (After Smith and Radcliffe, not seen by me).

Habitat: Gulf of Tomini, 1260 M, on a bottom of grey mud.

17. **Mastigopterus** Smith & Radcliffe

(Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 158)

Body mixoniform, tapering gradually into the long, slender tail. Head large, thick, with large sinuses and pores. Bones of the head heavy, firm. Jaws nearly equal. Teeth in narrow villiform bands in jaws and on vomer, in broad bands on palatines. Pseudobranchiae absent. Well developed gill rakers on first arch. Branchiostegals 8. Pyloric coeca rudimentary. Opercle armed with a thin, flat, triangular spine, nearly concealed by scales. Dorsal fin higher than anal. Caudal fin elongate, of few rays on a very narrow base. Pectoral rays greatly produced, their basal portion narrow, constricted, thickened, distal portion filamentous, the rays more or less separated. Ventrals long, each composed of 2 rays. Scales small, cycloid, covering head and body. Lateral line indistinguishable.

Distribution. Two deep sea species from the Philippines and the Moluccas, and if the genus *Grimaldichthys* Roule is a synonym of *Mastigopterus*, as suggested by Norman (John Murray Exp. Sc. Rep. VII, N° 1, 1939, p. 88), two more deep sea species from the Atlantic.

1. **Mastigopterus praetor** Sm. & Radcl. (Fig. 76, p. 435)

Mastigopterus praetor Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 160.

D. 131. A. 115. C. 6. P. 11. V. 2.

Height 6.51, 7.24 in length with caudal. Head 5.85, 6.51 in length with caudal. Eye 5.36, elliptical oval, 1.6 in flattened interorbital space. Snout 3.93, low, rather pointed, not projecting beyond mouth. Mouth large, slightly oblique. Maxillary 1.73 in head, extending 0.5 an eye diameter beyond vertical from posterior margin of eye. Narrow villiform bands of teeth in the jaws, broad bands on palatines and in a ∩-shaped patch on vomer. Opercle armed with a very thin flat spine, concealed by scales covering opercle. Preopercle unarmed. Gill rakers 5 + 15, 10 on lower arch prolonged, slender, the longest about three fourths diameter of eye. Between 40 and 45 scales between origin of anal and dorsal. Dorsal high, the longest rays slightly greater than snout plus eye. Origin of dorsal above base of pectoral, its distance from tip of snout 5.48, 6.1 in length with caudal. Inner ventral ray the longer, 1.25 times as long as head, its tip reaching vent. Longest pectoral rays about 4.5 times as long as head. Colour in alcohol clay, greyish white underneath scales. Cheeks, lips, and pectorals écru drab. Opercle with blackish shades underneath. Caudal, posterior rays and margin of anterior rays of dorsal and anal clove brown. Peritoneum dark seal brown.

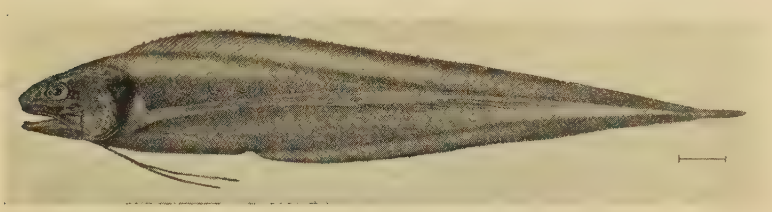

Fig. 76. *Mastigopterus praetor* Smith & Radcliffe. After Radcliffe.

Length 384 mm.(After Smith and Radcliffe, not seen by me).

Habitat: Patience Strait, at a depth of 2323 M, on a bottom of grey mud.

18. **Moebia** Goode & Bean

(Goode & Bean, Oceanic Ichthyol. 1896, p. 331)

Elongate. Body compressed, tail long and prolonged in a very slender filament, the dorsal and anal rays being extremely short posteriorly, but positively confluent with the caudal rays, which are much longer and much exserted. Ventrals each bifid. Head very cavernous, the sinuses large and conspicuous on the infraorbital ring, on the mandible, and the preopercle. A single, short, feeble spine on the shoulder, but none upon the opercle or preopercle. Mouth very wide, the extremity of the maxillary much dilated. Posterior nostrils very wide, and separated from the eye by a small, spinous projection of bone. Teeth in narrow bands on jaws, vomer, and palatines. Scales very thin, cycloid, small, with the exception of some which form a series running from the upper end of the gill opening towards the dorsal fin; these are about three times the size of the others. Gill rakers on outer arch rather numerous, long and slender. Pseudobranchiae represented by two minute globules.

Distribution that of the single species known.

1. **Moebia gracilis** (Gthr.) (Fig. 77, p. 436)

Bathynectes gracilis Günther, Ann. Mag. Nat. Hist. 1878, p. 21.
Porogadus gracilis Günther, Rep. Sc. Results Challenger. Zool. XXII, 1887, p. 112.

Greatest depth of body on a level with the root of the pectoral, and is two sevenths of the length of the trunk. Head nearly one half of the same length. Eye 5.5, two thirds of snout and of the interorbital space, which is somewhat convex. The integument of the head being very thin, underlying projections of the bone appear in preserved specimens as small prominent spines above the posterior portion of the eye. Mouth extending far beyond eye. The teeth form narrow bands, that of the vomer is ∧-shaped, with the two arms straight. Dorsal commencing above the root of the pectorals, its rays being of moderate length, but longer than those of the anal. Pectoral with feeble rays, tapering, as long as the head exclusive of the snout. Each ventral is composed of a bifid filament, the longer part of which extends backwards as far as the pectoral. About 24 scales in a transverse series running from the vent to the dorsal fin. Outer branchial arch with 16 gill rakers. Colour light brownish, head and abdomen black. Length of single specimen known 225 mm. (After Günther, not seen by me).

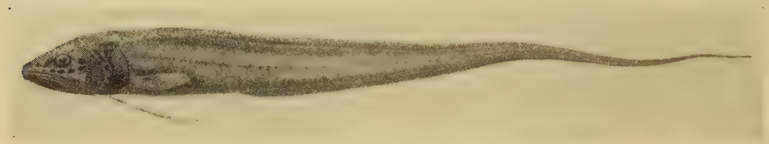

Fig. 77. *Moebia gracilis* (Gthr.) After Günther.

Habitat: South of New Guinea, at a depth of 2520 M.

19. **Enchelybrotula** Smith & Radcliffe

(Smith & Radclifft, Proc. U. S. Nat. Mus. XLIV, 1913, p. 154)

Body elongate, anguilliform. Head and body covered with long, elliptical oval, cycloid, persistent scales. Lateral line undistinguishable. Head without barbels. Mouth short, broad. Teeth small, in a simple series on jaws, vomer, and palatines. Eye small, deep-set. Opercular spine feeble, covered with skin. Preopercle unarmed, lower margin free. Gill rakers few, small, tubercle-like. Branchiostegals 7. Stomach greatly elongated, opening of pylorus on mesial portion of its ventral surface, no pyloric coeca. Urinary bladder exceedingly large. Dorsal and anal long, continuous with caudal. Pectorals short, acutely rounded. Ventrals long, each consisting of 2 divided rays.

Distribution that of the single species known.

1. **Enchelybrotula paucidens** Sm. & Radcl. (Fig. 78, p. 437)

Enchelybrotula paucidens Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 154.

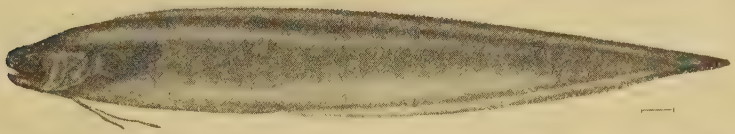

Fig. 78. *Enchelybrotula paucidens* Smith & Radcliffe. After Radcliffe.

D. 125. A. 90. C. 10. P. 22. V. 2. Ll. about 200. Ltr. 43 (from origin of A to D).

Height 7.14, 7.82 in total length. Head 7.7, 8.42 in total length. Eye 9.28, 3 in interorbital space. Snout 3.71 in head, bluntly rounded, scarcely projecting beyond mouth. Maxillary reaching slightly beyond vertical from posterior margin of eye. Lower jaw included. Gill rakers 4 + 5, reduced to slight protuberances. The two rays of each ventral joined together broadly for a distance equal to twice diameter of eye, the inner ray the longer, a little longer than head. Bases of ventrals close together, behind tip of symphysis of cleithra. Pectorals 1.3 in head. Colour in alcohol olivaceous. Margin of opercle, lips, and fins slightly darker. The posterior rays of dorsal and anal and the caudal clove brown. Peritoneum cinnamom, punctulate with darker. Length 547 mm. (After Smith & Radcliffe, not seen by me).

Habitat: Gulf of Tomini, Celebes, at a depth of 1960 M, on a botom of grey mud.

20. **Dinematichthys** Bleeker

(Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 318)

Body elongate, compressed. Body and sides of head covered with scales. No barbels. An opercular spine present. Gill openings wide. Gill rakers on anterior arch usually reduced to a few well developed rakers near angle of arch. Villiform teeth in bands on jaws, vomer, and palatines. Dorsal and anal long, not confluent with caudal, but ending near its base. Pectorals rounded. Ventrals consisting each of a single filamentous ray, both fins close together. Caudal rounded. Branchiostegals 6. No pseudobranchiae.

Distribution: Mauritius, Andamans, Philippines, Indo-Australian Archipelago, Australia, New Zealand, eastwards to Tahiti. Coastal fishes.

1. **Dinematichthys iluocoeteoides** Blkr. (Fig. 79, p. 439)

Dinematichthys iluocoeteoides Bleeker, Nat. Tijdschr. Ned. Indië VIII, 1855, p. 319.

Dinematichthys iluocoeteoides Günther, Cat. Brit. Mus. IV, 1862, p. 374.

Dinematichthys illuocoeteoides Lunel, Mém. Soc. Phys. Nat. Hist. 1881, p. 274.

Dinematichthys iluocoetoides Steindachner, Abh. Senckenb. naturf. Ges. XXV 1901, p. 443.

Dinematichthys iluocoeteoides Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 435.

Dinematichthys iluocoeteoides Jordan & Richardson, ibid. XXVII (1907) 1908, p. 286.

Dinematichthys illuocoeteoides Günther, Fische der Südsee III, 1909, p. 336.

Dinematichthys iluocoeteoides Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 444.

?*Ogilbia ventralis* Borodin, Bull. Vanderbilt marine Mus. I, Art. 3, 1932, p. 97 (nec Gill?).

Dinematichthys iluocoeteoides L. P. Schultz, Bull. U. S. Nat. Mus. 180, 1943, p. 287.

D. 80-85. A. 56-69. P. 22-23. V. 1.

Height 5.3. Head 4. Eye more than 5, a little less than interorbital space. Upper jaw twice in head, scarcely longer than lower jaw, with a spinous process at the lower angle of the maxillary. Teeth in several series on jaws, in a long narrow band on palatines and on vomer in a $\wedge$-shaped patch. About 100 scales in a lateral line. Lateral line straight, running along median line of sides, and reaching base of caudal. Origin of dorsal above the middle of the pectoral. Anal somewhat deeper than dorsal. Colour of preserved specimens greyish brown. In life brillant orange red or greyish, the posterior parts golden shaded. Length 70 mm. (Compiled, not seen by me).

Habitat: Singapore; Batu Islands; Nias; Sumatra (Benkulen); Java (Prigi); Bali?; Celebes (Mamudju); Sulu Islands; Halmahera; Goram. — Mauritius, Philippines, Torres Strait, Ponapé, Samoa, Tahiti.

On reefs, according to Steindachner l.c. also in fresh water.

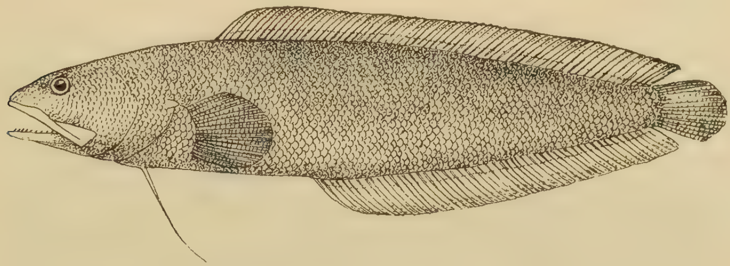

Fig. 79. *Dinematichthys iluocoeteoides* Blkr. After a drawing made for the Atlas under direction of Bleeker and after the type specimen.

21. **Cataetyx** Günther

(Günther, Challenger Rep. Zool. XXII, 1887, p. 104)

Body compressed, elongate, covered with very small and thin scales. Lateral line double, indistinct. Head oblong, with somewhat pointed snout, covered with very small scales, only the anterior part of the snout naked. Bones of the head rather firm, but with the muciferous system well developed, the canals having wide openings along the infraorbital, and on the lower limb of the preopercle. Eye rather small. Nostrils far apart, the posterior in front of the eye and the anterior at the extremity of the snout. Opercle with a spine behind, no other armature on the head. Snout not swollen, but the upper jaw slightly overlapping the lower. Barbels none. Mouth wide. Bands of villiform teeth in the jaws, on the vomer and the palatines; a series of larger teeth along the sides of the lower jaw. The tail is not much attenuated. Vertical fins confluent. Ventrals close together, reduced to a pair of fine simple filaments, and inserted somewhat behind the isthmus, below the middle of the opercle. Gills four, with a few well developed rakers near angle of arch, and well developed laminae. Pseudobranchiae none or rudimentary. Branchiostegals 8. Two flap-like appendages near pylorus.

Distribution. Six species from deep water of the Indic and Pacific.

1. **Cataetyx platycephalus** Sm. & Radcl. (Fig. 80, p. 440)

Cataetyx platycephalus Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 169.

D. 98. A. 68. C. 11. P. 22. V. 1. Ltr. 26 (between origin of A and D).

Head 4.08, 4.61 in length with caudal, long, low-depressed, its width at eyes greater than its depth. Outline of dorsal surface longitudinally very slightly concave, laterally broadly convex; a series of large pores on lower suborbital region, preopercle and mandible, 3 large pores in a line between eye and shoulder, 2 on top of head behind eye, 1 between eyes, and 2 in front of eyes. Body slender, strongly compressed posteriorly, greatest depth 6.12, 6.92 in length with caudal. Eye 5.13, small, superior. Snout slightly longer than eye, broad and bluntly rounded. Mouth wide, oblique, jaws subequal. Maxillary extending beyond vertical from posterior margin of eye, upper margin slipping under suborbital. Small equal villiform teeth in bands on jaws, vomer, and palatines. Interorbital space very narrow and flat. Anterior nostril tubular, on anterior margin of snout, posterior larger, near eye. Opercle armed with a long slender spine, preopercle unarmed. Three of the gill rakers at angle of arch moderately developed, the others reduced to knob-like protuberances. Cheek and opercle scaled, those on postorbital part of head apparently lost with age. Origin of dorsal behind axil of pectoral, its distance from tip of snout 3 in length without caudal. Origin of anal slightly nearer tip of snout than

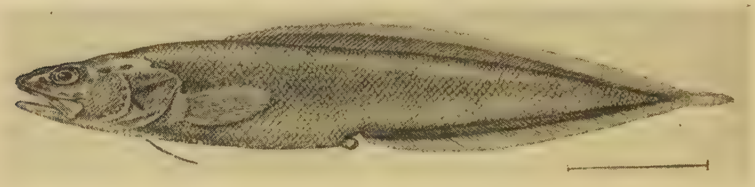

Fig. 80. *Cataetyx platycephalus* Sm. & Radcl.

tip of caudal. Ventrals 2.17, each consisting of 2 closely bound rays, bases close together behind symphysis of cleithra, much more than a head length in advance of origin of anal. Pectoral 1.86, narrow. Colour in alcohol: Clay, the dark coloration of the peritoneum and lining of the gill cavity showing through on belly and opercle; peritoneum brownish black. Length 130 mm (After Smith and Radcliffe, not seen by me).

Habitat: Molucca Passage, 750 m, on a bottom of grey mud. — Philippines, 1260 M.

22. **Hypopleuron** Smith & Radcliffe

(Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 164)

Body slender, elongate, covered with small cycloid scales. Head low, depressed, elongate, scaled. Teeth on mandible in a narrow band, villiform, some of those in the outer row somewhat enlarged. A pair of small canine-like teeth on either side of symphysis of upper jaw. Premaxillary band villiform. Patch on vomer ∩-shaped, some of the teeth enlarged. Band on palatines narrow with a few enlarged teeth. Eyes lateral, high. Opercle and preopercle unarmed. Vertical fins united. Ventrals very small, simple, close together, situated behind tip of symphysis of cleithra. Pectorals elongate, narrow. Gills 4, gill filaments well developed, only 3 developed gill rakers on first arch. Pseudobranchiae present. Branchiostegals 8. Pyloric coeca well developed. Lateral line broad anteriorly, narrowing posteriorly and disappearing on tail, structurally very much like *Lamprogrammus,* possessing the outer band of small scales pierced at regular intervals by pores, and an inner series of enlarged platelike scales. Parapophyses of abdominal vertebrae broadened, lengthened, and bent inward at ends and sides, the whole forming a large bony case containing the air bladder.

1. **Hypopleuron caninum** Sm. & Radcl. (Fig. 81, p. 442)

Hypopleuron caninum Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 165.

D. 160. A. 122. P. 24. V. 1.

Height 8.28, 8.52 in length with caudal. Head 5.12, 5.18 in length with caudal. Eye 6.78, 1.68 in the pointed depressed snout, and 1.42 in the broad, flattened interorbital space. Mouth large, oblique; lower jaw narrow, projecting beyond tip of upper. Maxillary reaching vertical from posterior margin of eye. Mandibular teeth in narrow bands, small, villiform, interspersed with a few slightly enlarged teeth on sides. Premaxillary band of teeth somewhat wider, villiform, a pair of small, incurved canines on anterior margin. Vomerine teeth unequal. Palatine band narrow, a few enlarged teeth present. Origin of dorsal a head length behind tip of snout. Distance of anal from tip of snout 2.22 in length, 2.28 in length with caudal. Ventrals about equal to diameter of eye. Pectorals 1.41 in head. Colour in alcohol: Back and sides raw umber; belly straw yellow, punctulate with black dots. Vertical fins similar to adjacent body colour, punctulate with black, the black margin of the dorsal and anal widening posteriorly to include entire fin. Pectorals dusky. Length 570 mm (After Smith and Radcliffe, not seen by me).

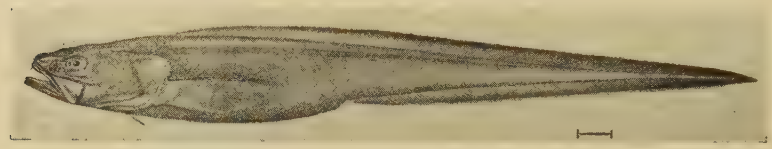

Fig. 81. *Hypopleuron caninum* Smith & Radcliffe. After Radcliffe.

Habitat: Near Kajo, at a depth of 577 M. — Philippines.

Note. The authors observe that the form and structure of this fish indicate that it is a very active species, not confining itself to the bottom region.

23. **Xenobythites** Smith & Radcliffe

(Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 173)

Body relatively short, covered with small, thin scales. Head high, depressed anteriorly, cheeks and opercles covered with small, inconspicuous scales; a few small cilia scattered over naked portions of head. Bones of skull firm. Snout low. Upper jaw very slightly overhanging lower. Narrow bands of slightly unequal villiform teeth on jaws and palatines; patch on vomer arched, the teeth mainly in 2 rows. Eyes lateral. Opercle armed with a slender spine. Margin of preopercle armed with 5 or 6 spines, portion between spines incised. Lateral line inconspicuous, interrupted in the middle, the two parts overlapping the same vertical. Branchiostegals 8. Gill filaments short. Gill rakers on anterior arch reduced to six. Pseudobranchiae consisting of 2 small filaments. A short, thick, flap-like appendage on each side of the pylorus. Vertical fins united. Ventrals absent. Pectorals simple. Caudal pointed. Viviparous.

Distribution that of the single species known.

1. **Xenobythites armiger** Sm. & Radcl. (Fig. 82, p. 443)

Xenobythites armiger Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 173.

D. about 85. A. 72. P. 22.

Height 3.64, 3.90 in length with caudal. Head 3.23, 3.47 in length with caudal, short, depressed anteriorly, very strongly arched posteriorly, considerably deeper than broad, naked portions covered with small, scattered cilia. Suborbital porous. Eye 5.5, 1.32 in snout, 1.9 in broad, slightly convex interorbital space. Mouth broad, oblique, lower jaw slightly included. Maxillary extending about 0.5 an eye diameter beyond vertical from posterior margin of eye, the upper margin slipping under suborbital. Bands of slightly unequal villiform teeth on jaws and palatines, patch on vomer arched, mainly in two rows. Dorsal posterior in its insertion, its distance from tip of snout 2.15 in standard length. Pectoral 2 in head. Caudal pointed. Colour in alcohol clay colour, becoming greyish ventrally; area in front of vent and median line of belly black. Under side of head cream buff. Fins translucent. Peritoneum very dark seal brown. Length 760 mm.

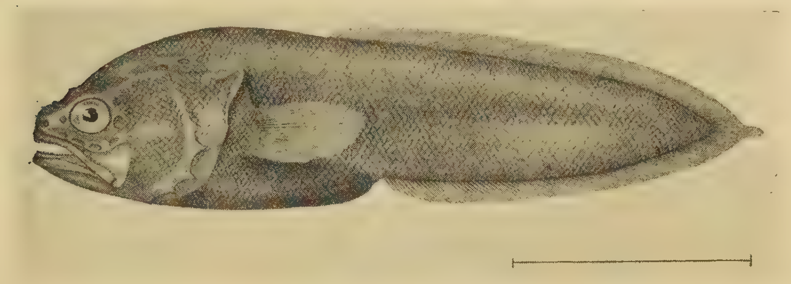

Fig. 82. *Xenobythites armiger* Smith & Radcliffe. After Radcliffe.

Habitat: Near Makjan, 518 M. — Macajalor Bay, Mindanao, 360 M, on a bottom of green mud.

24. **Hephthocara** Alcock

(Alcock, Ann. Mag. Nat. Hist. (6) X, 1892, p. 349)

Body elongate, compressed, tail tapering to a filament, covered with small, thin, deciduous, slightly imbricate, cycloid scales. Head large and broad, covered with a thick gelatinous scaleless skin. Lateral line indistinguishable. Snout broad, depressed, not overhanging the jaws, without barbels. Mouth wide, oblique. Villiform teeth on the jaws and palatines, and in a crescent on the vomer. Dorsal and anal fins long, confluent with the caudal. No ventral fins. Gill openings wide. A few well developed gill rakers near angle of anterior arch, followed by some smaller ones. Eight branchiostegals. No pseudobranchiae. Air bladder present. No pyloric coeca.

Distribution. Two species from the deeper parts of the Indic and Western Pacific.

1. **Hephthocara crassiceps** Sm. & Radcl. (Fig. 83, p. 445)

Hephthocara crassiceps Smith & Radcliffe, Proc. U. S. Nat. Mus. XLIV, 1913, p. 174.

D. about 140. A. about 105. P. 19.

Head 4.85 in total length, very large, broad, and deep, its breadth about 0.75 in its length, its depth about equal to its length. Upper surface of snout nearly horizontal, nearly on a level with upper margin of eye, from this point the contour line rises very abruptly, the posterior part of the head being much inflated. Body not as deep as head. Eye 6.44, 1.78 in snout, 2.33 in interorbital space. Mouth very broad, lower jaw included. Maxillary 1.87 in head, all except the lower posterior margin concealed by suborbital, reaching about 0.5 an eye diameter beyond vertical from posterior margin of eye. A narrow band of small, unequal teeth with incurved tips on mandible; a broad band of villiform teeth on premaxillaries; teeth on vomer and palatines in very narrow bands. Opercle armed with a rather weak spine. Preopercle unarmed. Origin of dorsal from tip of snout 4.10 in total length. Origin of anal from tip of snout 2.67. About 22 scales from origin of anal to dorsal. Pectorals longer than snout plus eye. Colour in alcohol: Body russet, becoming dusky black on belly; the thin outer skin of head and fins clove brown; inside of gill chamber and peritoneum dark clove brown. Length about 280 mm (After Smith & Radcliffe, not seen by me).

Habitat Buton Strait, at a depth of 934 M, on bottom of green mud.

6. Family OPHIDIIDAE

Body elongate, compressed, usually covered with very small scales, which are not imbricated as a rule, but arranged in oblique series at right angles with each other as in an eel. Dorsal and anal well developed, confluent with caudal. Ventrals reduced to long forked barbels, and inserted on the throat, between the rami of the lower jaw. Vent remote from the head. Mouth generally protractile. Gill openings wide, but the gill membranes attached to the isthmus.

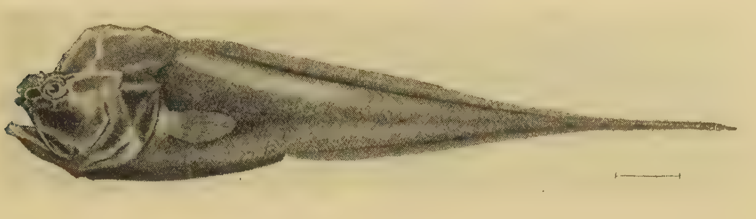

Fig. 83. *Hephthocara crassiceps* Smith & Radcliffe. After Radcliffe.

1. **Ophidion** Linné

(Linné, Syst. Nat. Ed. 10. Vol. I, 1758, p. 259)

Ophidium auctorum.

Dorsal and anal low, confluent with the caudal. Head naked. Teeth in the jaws fixed, forming bands, generally small, those on the vomer and palatines small. Lower jaw received within the upper. Seven branchiostegals. No pyloric appendages.

Distribution: Mediterranean, Atlantic, Indic, and Pacific.

1. **Ophidion muraenolepis** (Gthr) (Fig. 84, p. 446)

Ophidium muraenolepis Günther, Rep. Challenger. Zool. Vol. I, Part VI, 1880, p. 46. ibid. Vol. XX, 1887, p. 268.

?*Otophidium asiro* Jordan & Fowler, Proc. U. S. Nat. Mus. XXV, 1902, p. 752.

The length of the head equals its distance from the vent, which is somewhat nearer to the end of the snout than to that of the tail. The scales are extremely small, not imbricate, elongate, and obliquely arranged as in an eel. The outer pair of barbels is considerably longer than the inner, and much shorter than the head. The lower branch of the outer branchial arch with four gill rakers, which are very short, scarcely one third of the diameter of the eye. No hook-like prominence at the ethmoid. Head entirely naked. Dorsal fin with a blackish edge. Length 175 mm (After Günther, not seen by me).

Habitat: Kei Islands, 232-252 M. — Japan?

Note. The description of this species by Günther, copied above, is very scanty, and re-examination of the type is desired. *Otophidium asiro* seems to be very near to, or perhaps identical with it. The genus *Otophidium* differs from *Ophidion* in the form of the air bladder, and the opercle ends in a concealed spine, differences which are more of a specific than of a generic character. Nothing is known about the air bladder of *O. muraenolepis* and Günther does not mention the opercular spine.

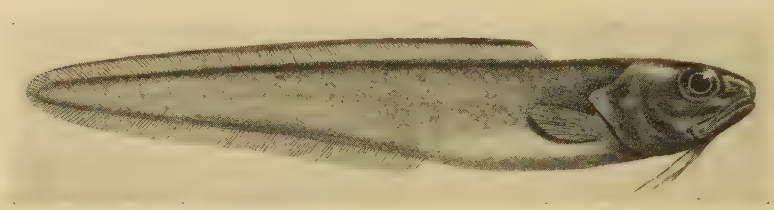

Fig. 84. *Ophidion muraenolepis* (Gthr.). After Günther.

7. Family PHOLIDICHTHYIDAE

Elongate, more or less eel-like. Body naked or with small scarcely conspicuous scales, imbedded in the skin. Teeth in jaws. No teeth on vomer or palatines. Gill openings wide or restricted to the sides. Dorsal and anal consisting of flexible simple rays, confluent with caudal or only connected to it by membrane. Pectorals present. Ventrals filamentous, consisting of two rays, their origin scarcely before that of pectorals. Lateral line absent.

Distribution that of the two genera described below.

Note. I have united *Pholidichthys* and *Gunellichthys* in a separate family, but as long as the anatomy of these fishes is not known, it cannot be proved that this association is a natural one. Jordan (Classification of Fishes, Stanf. Univ. Publ. Biol. Sc. III, N° 2, 1923, p. 233) places these genera with *Chaenopsis, Stathmonotus, Psednoblennius,* and *Lucioblennius* in a provisional family Chaenopsidae.

Key to the Indo-Australian genera of Pholidichthyidae

a. Dorsal and anal confluent with caudal. Gill openings wide. No scales. . . .	1. *Pholidichthys* p. 447.
b. Dorsal and anal free from caudal or connected by membrane only. Body covered with rudimentary scales. Gill openings restricted to the sides . .	2. *Gunellichthys* p. 448.

1. **Pholidichthys** Bleeker

(Bleeker, Nat. Tijdschr. Ned. Indië XI, 1856, p. 406)

Very elongate, compressed. No scales. Gill openings wide, gill membranes free from each other and from isthmus. Dorsal and anal long, consisting of flexible simple rays, and united with the caudal, which is rounded. Ventrals small, filiform, consisting of two rays, their origin scarcely in advance of that of pectorals. Teeth in jaws pointed, in one row on the sides, in more rows near symphysis, where some of the teeth, and especially those in the upper jaw, are canines. Palate edentulous. No lateral line.

Distribution that of the single species known.

1. **Pholidichthys leucotaenia** Blkr. (Fig. 85, p. 448)

Pholidichthys leucotaenia Bleeker, Nat. Tijdschr. Ned. Indië XI, 1856, p. 406.

D about 66. A about 55. P. 14. V. 2.

Height 10.5, 11.4 in length with caudal. Head 5, 5.5 in length with caudal. Eye 4.7. Snout equal to interorbital space and five sevenths of eye. The interorbital space is scarcely convex. Mouth oblique. Maxillary reaching to below middle of eye. Origin of dorsal above gill opening. Pectorals as long as snout and eye, ventrals as long as eye. Colour of preserved specimen now uniform brownish, but according to Bleeker when fresh black above, white below. A white longitudinal stripe from eye to caudal. Caudal and pectorals rather dark. Dorsal and anal hyaline, the dorsal with a black longitudinal terminal band. Length 91 mm. (Description made after the type and single specimen known in the Leiden Museum).

Habitat: Buru!

2. **Gunellichthys** Bleeker

(Bleeker, Acta Soc. Sc. Indo-Neerl. III, 1858. Tiende Bijdr. Kennis Vischf. Celebes, p. 9)

Much elongate, compressed. Scales small, rudimentary, imbedded in the skin. Gill openings restricted to the sides, the gill membranes being attached to the isthmus. Dorsal and anal long, consisting of flexible simple rays, connected by a low membrane only to the caudal. Ventrals small, consisting of two rays, their origin scarcely before that of pectorals. Teeth in jaws pointed, some of them canine-like. No teeth on palate. No lateral line.

Distribution that of the single species known.

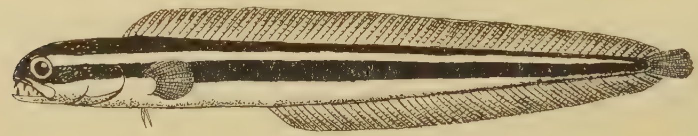

Fig. 85. *Pholidichthys leucotaenia* Blkr. After a drawing made for the atlas under direction of Bleeker.

1. **Gunellichthys pleurotaenia** Blkr (Fig. 86, p. 449)

Gunellichthys pleurotaenia Bleeker, Acta Soc. Sc. Indo-Neerl. III. 1858. Tiende Bijdr. Kennis Vischf. Celebes, p. 10.

D. 56-59. A. 34-37. P. 1.12. V. 2.

Height 12.1-14.4, 13.4-15.9 in length with caudal. Head 7.2-7.3, 7.9 in length with caudal. Eye 5.5-6.7, about equal to snout and to slightly convex interorbital space. Mouth oblique. Maxillary reaching to below anterior part of eye. Gill opening oblique, longer than base of pectoral. Origin of dorsal slightly behind head, that of anal in the middle between the point of the snout and the base of the caudal. Pectorals rounded, almost equal to postorbital part of head. Ventrals equal to one and a half eye diameters. Colour of preserved specimen yellowish. A dark band from snout through eye to base of caudal, and continued on the proximal half of that fin, which is rounded. Fins hyaline. Dorsal with a subterminal black longitudinal band. Length 87 mm. (Type of species seen in the Leiden Museum).

Habitat: Bali!; Celebes (Menado!). In sea.

8. Family CARAPIDAE (FIERASFERIDAE)

Elongate or much elongate, compressed or cylindrical. Body and tail tapering to a point. No scales. Dorsal and anal long, confluent round tail. No caudal. Ventrals absent. Pectorals present or absent. Vent anterior, immediately behind head. Mouth not protractile. Gill openings wide, the gill membranes free from isthmus and only connected anteriorly.

Distribution. Three genera *Carapus, Disparichthys,* and *Echeliophis,* lastnamed genus which differs by the absence of pectorals, from the Philippines and several islands in the Pacific, but not yet found in the Indo-Australian Archipelago.

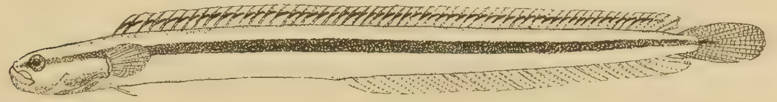

Fig. 86. *Gunellichthys pleurotaenia* Blkr. × 1$^1/_7$.

Key to the Indo-Australian genera of Carapidae

a. Teeth on palatines. Body and tail compressed, generally not very much elongate	1. *Carapus* p. 449.
b. No teeth on palatines. Body and tail cylindrical, very much elongate . .	2. *Disparichthys* p. 454.

1. **Carapus** Rafinesque

(Rafinesque Indice d'Ittiologia, 1810, p. 37, p. 57)

Fierasfer (Cuvier) Oken, Isis, 1817, p. 1182.
Oxybeles Richardson, Zool. Erebus and Terror, 1844, p. 74.
Jordanicus Gilbert, Bull. U. S. Fish Comm. (1903), 1905, p. 656.

Compressed, elongate, seldom very much elongate. No scales. Eyes without free orbital margin. Mouth rather large, terminal or slightly inferior, not protractile. Teeth in jaws, on palatines, and on vomer. Gill openings rather wide. Gill membranes not attached to the isthmus. Dorsal and anal confluent round tail. Dorsal generally low. No ventrals. Pectorals present, moderately developed. Vent somewhat before or behind base of pectorals. Lateral line present. No pseudobranchiae. Branchiostegals 7.

Distribution. Atlantic, Mediterranean, Indic, and Pacific. The species live in Holothurians, Starfishes, Lamellibranchiata, and have also been found in Tunicata. Specimens of species which normally are found in one of these hiding places, have also been captured below coral blocks and such like.

Key to the Indo-Australian species of Carapus

A. Height 9-16 in total length.
- *a*. Maxillary not hidden by the skin. Lower lip with a transverse fold (*Carapus* s.s.).
  - a^1. Moderately compressed, the breadth of the body 1.6-1.8 in the height. No real canines in front of the jaws. Vomer with large curved canines. Vent before base of pectorals. . . 1. *C. homei* p. 450.
  - b^1. Much compressed, the breadth 2.2-2.4 in the height. Two canines in front of upper and lower jaw. Small teeth on vomer. Vent behind base of pectorals . . . . 2. *C. margaritiferae* p. 452.
- *b*. Maxillary hidden below the skin. Lower lip without transverse fold (*Jordanicus*). A few large blunt teeth on vomer . . . . 3. *C. gracilis* p. 453.

B. Height more than 40 in total length. 4. *C. lumbricoides* p. 454.

1. **Carapus homei** (Rich.) (Fig. 88, p. 452)

Oxybeles homei Richardson, Zool. Voy. Erebus & Terror, Part II, Fishes. 1844-1848, p. 74.

Oxybelus Brandesii Bleeker, Nat. Tijdschr. Ned. Indië I, 1850, p. 278. — Verh. Bat. Gen. XXIV. Bijdr. kennis Chirocentr. etc. 1852, p. 24. — Nat. Tijdschr. Ned. Indië VII, 1854, p. 162, p. 495.

Fierasfer Homei Kaup, Cat. Apodal Fish. Brit. Mus. 1856, p. 158.

Fierasfer Brandesii Bleeker, Nat. Tijdschr. Ned. Indië XV, 1858, p. 204.

Fierasfer homei Günther, Cat. Brit. Mus. IV, 1862, p. 382.

Fierasfer Homei Putnam, Proc. Boston Soc. Nat. Hist. XVI, 1874, p. 345.

Fierasfer Homei Macleay, Descr. Cat. Austr. Fish. II, 1881, p. 120.

Fierasfer homei Day, Fishes of India. Suppl. 1888, p. 805.

Fierasfer homei Steindachner, Denkschr. Akad. Wien LXX, 1900, p. 510.

Fierasfer homei Johnstone, Rep. Pearl Oyster Fisheries. Suppl. Rep. XV. Marine Fishes, 1904, p. 211.

Fierasfer homei Steindachner, Sitzber. Akad. Wien CXV, 1906, p. 1419.

Fierasfer homei Jordan & Seale, Bull. Bur. Fish. XXV (1905) 1906, p. 435.

— ibid. XXVI (1906) 1907, p. 48.
Fierasfer homei Jordan & Snyder, ibid. (1906) 1907, p. 217.
Fierasfer homei Günther, Fische der Südsee III, 1909, p. 338.
Fierasfer homei M. Weber, Siboga Exp. Fische, 1913, p. 96 (pro parte).
Fierasfer Sluiteri M. Weber, ibid. p. 97.
Carapus homei Fowler, B. P. Bishop Mus. X, 1928, p. 445.
Carapus homei Herre, Field Mus. Nat. Hist. Zool. Ser. XXI, 1936, p. 416. — Rec. Indian Mus. XLI, 1939, p. 371.

Height 9-11.1 in total length. Breadth 1.6-1.8 in height. Head 6.8-7.3. Eye 3.7-4.4, more than snout and than somewhat convex interorbital space. Mouth oblique. Maxillary which is not hidden by skin, reaching beyond hindborder of eye. Lower lip with a transverse fold. A rather narrow cardiform band of teeth in upper and lower jaw, the outer row consisting of larger teeth; a pair of caninoid teeth in front in the upper jaw, in the lower jaw the anterior teeth of the outer row are smaller than the posterior ones, which are sometimes canines. On the vomer a median row of three or four large curved canines, which are more or less coalesced and which are flanked on both sides by a row of small teeth. Similar small teeth in several rows on palatines. Gill opening reaching from above base of pectoral to below hindborder of preopercle. Distance of origin of dorsal from head somewhat less than length of head. Dorsal very low, lower than anal. Origin of anal immediately behind vent which is situated before the base of the pectoral. Pectorals pointed, equal to postorbital space in small specimens, in large specimens as long as eye and snout. Yellowish, often with a golden hue along sides, sometimes with black spots on tail. Length 200 mm.

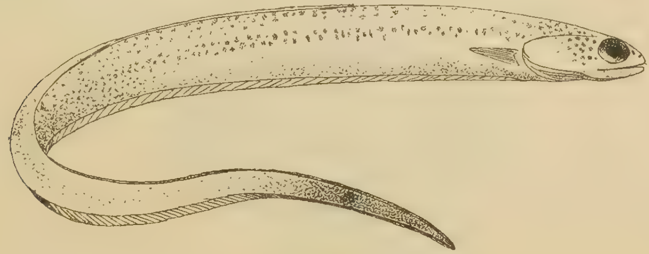

Fig. 87. *Carapus gracilis* (Blkr.) n.s.

Habitat: Borneo Bank!; Celebes (Menado!); South Island!; Saleyer!; Binongka!; Rotti!; Timor!; Ceram; Ambon; Goram; Lucipara; Banda; Ternate; Misol; New Guinea (Dörper Spitze). — Madagascar, Zanzibar, Mauritius, Réunion, Coast of India, Ceylon, Andamans, Cocos Keeling Islands, Philippines, Torres Straits, Queensland, Tasmania, Marshall Islands, Admirality Islands, New Britain, Solomon Islands, Santa Cruz Islands, New Caledonia, Kingsmill Islands, Funafuti, Fiji, Samoa, Society Islands, Hawaii.

Living in Holothurians and in Starfishes, one found in *Styela,* and once in *Cardium.*

2. **Carapus margaritiferae** (Rendahl)

Fierasfer homei M. Weber, Siboga Exp. Fische, 1913, p. 96 (pro parte).
Fierasfer margaritiferae Rendahl, Kungl. Svenska Vetensk. Akad. Handl. LXI, N° 9, 1921, p. 5.
Carapus margaritiferae McCulloch, Mem. Austr. Mus. V, Part III, 1929, p. 354.

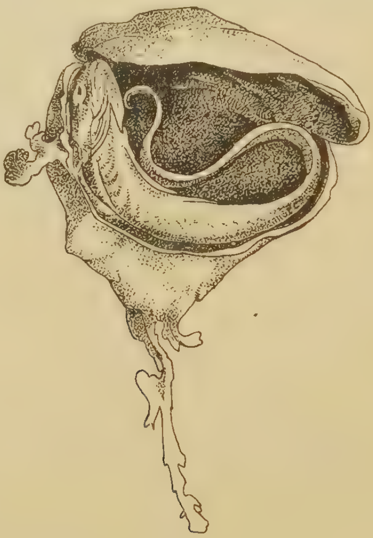

Fig. 88. *Carapus homei* (Rich.) in *Styela aurata* Q. G. After M. Weber.

Height 9.4-11.6 in total length. Breadth 2.2-2.4 in height. Head 7.6-9 in total length. Eye 3.6-4.4, equal to or somewhat more than snout. Interorbital space somewhat convex, less than eye. Mouth much oblique. Maxillary which is not hidden by skin, reaching far beyond hindborder of eye. Lower lip with a transverse fold. Jaws with bands of small teeth, two canines anteriorly in the upper jaw, and two large and often fang-like ones in the lower jaw. A patch of small teeth on vomer, and elongate ones on palatines. Distance of origin of dorsal from head about one fourth of length of head. Dorsal low, lower than anal. Origin of anal behind base of pectoral, which is half as long as head. Yellowish, posterior part of tail blackish. Length 92 mm.

Habitat: Between Pulu Punga and Pulu Missa, coast of Flores, in *Avicula* (*Pteria*)!; Saleyer, below coral blocks on the reef and in a Holothurian! — Cape Jaubert, N. W. Australia, in *Pteria*.

Note. This species has been found in Pearl Oysters (*Pteria*), once below coral blocks, and once in an unidentified Holothurian. The very compressed head, body, and tail may be an adaptation to the life in these molluscs.

3. **Carapus gracilis** (Blkr) (Fig. 87, p. 451)

Oxybeles gracilis Bleeker, Nat. Tijdschr. Ned. Indië XI, 1856, p. 105.
Oxybeles gracilis Doleschall, ibid. XV, 1858, p. 163.
Fierasfer gracilis Günther, Cat. Brit. Mus. IV, 1862, p. 382.
Fierasfer umbratilis Jordan & Evermann, Bull. U. S. Fish. Comm. XXII (1902), 1904, p. 206.
Fierasfer umbratilis Jordan & Evermann, ibid. XXIII, Part I (1903) 1905, p. 505.
Jordanicus umbratilis Gilbert, ibid. Part II (1903) 1905, p. 656.
Jordanicus gracilis Günther, Fische der Südsee III, 1909, p. 339.
Fierasfer frantii Popta, Notes Leyden Mus. XXXIV, 1912, p. 185.
Fierasfer parvipinnis M. Weber, Siboga Exp. Fische, 1913, p. 97 (nec Kaup).
Fierasfer gracilis Barnard, Ann. S. Afric. Mus. XXI, Part 2, 1927, p. 886.
Jordanicus gracilis Fowler, Mem. B. P. Bishop Mus. X, 1928, p. 446. — ibid. XI, N° 5, 1931, p. 364. — ibid. XI, N° 6, 1934, p. 447.

Height 13.2-16 in total length. Head 4.2-4.8 in total length. Eye 4.2-4.8. Snout equal to almost flat interorbital space, and 1.4-1.6 in eye. Mouth nearly horizontal. Maxillary hidden below the skin, its posterior extremity reaching slightly beyond the hindborder of the eye. Lower lip without transverse fold. A single row of small pointed teeth in the jaws, and on the palatines. On vomer a few large, blunt teeth, more or less coalesced at base. Gill opening reaching from upper base of pectoral to below end of maxillary or not so far. Dorsal so low anteriorly that its exact origin cannot be made out, posteriorly it is also much lower than the anal, the origin of which is situated below or slightly in front of base of pectoral. Pectorals pointed, short, equal to snout and half eye. Colour of preserved specimens yellowish with brown and black spots, more or less arranged in numerous transverse bands on the back. One specimen is dark violet, somewhat lighter below. Length 170 mm.

Habitat: Pulu Weh!; Nias!; Celebes (Kwandang Bay!); Muna; Ceram; Ambon; Banda; Waigeu; New Guinea. — Coast of Natal, Cocos Keeling Islands, Pelew Islands, Fiji, Samoa, Tonga Islands, Wallis Island, Rotuma, Hawaii.

Living in Holothiurians and Starfishes, according to Miss Popta also found in brackish water.

Note. The specimen mentioned by M. Weber l.c. as *parvipinnis* belongs to *gracilis,* and not to the species of Kaup, which is quite different, having the maxillary not hidden and the mouth very oblique. In the elaborate description of *F. frantii* I cannot find any characteristics to distinguish it from *gracilis.*

4. **Fierasfer lumbricoides** (Blkr.)

Oxybeles lumbricoides Bleeker, Nat. Tijdschr. Ned. Indië VII, 1854, p. 163.
Fierasfer lumbricoides Günther, Cat. Brit. Mus. IV, 1862, p. 384.
Helminthoides lumbricoides Gill, Proc. Acad. Nat. Sc. Philadelphia XVI, 1864, p. 203.
Fierasfer lumbricoides Tate Regan, Trans. Linn. Soc. London 2. Ser. Zoology, XII, Part 3, 1908, p. 220.
Pirellinus lumbricoides Whitley, Rec. Austr. Mus. XVI, 1928, p. 226.

Here follows a translation of what Bleeker l.c. says about this species: "I am in the possession of still another species of *Oxybelus,* which I call *Oxybelus lumbricoides* on account of its slender body. This species has been found near Ceram. As the single specimen is mutilated I am unable to give a full description. Its length is 142 mm, but part of the tail is wanting. Neverless the height of the body is contained more than 40 times in the length, and the head about 21 times. The arrangement of the teeth is totally that of the genus *Oxybelus.* The maxillary ends below the posterior part of the eye, and the pectorals are very poorly developed". This is all what has ever been written on this species. The type specimen seems to be lost, at least the species is not recorded in the catalogue of the sale of Bleeker's collections. Gill, without having seen a specimen, created a new genus for it and Whitley changed the name, as that of Gill is preoccupied. Regan is the only one who records a second specimen, viz. from the Chagos Archipelago. It is a pity that he did not give a description. It is quite possible that it belongs to a different genus, as was the opinion of Gill, and perhaps it ought to be placed in the genus *Disparichthys,* which name in that case has to be changed into *Pirellinus.*

2. **Disparichthys** Herre

(Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII, N° 12, 1935, p. 383)

Very much elongate, cylindrical. No scales. Eyes with a free orbital margin. Mouth rather large. Jaws even. Small teeth in a single series in jaws. On vomer two large rather strong teeth behind each other. Gill openings wide and nearly confluent. Dorsal and anal confluent round tail. Dorsal beginning about middle of fish or somewhat more anteriorly. Origin of anal at a short distance behind head. Vent close behind head. Pectorals present, but short.

Distribution. Three species are known, one from New Guinea and other from Tahiti, and one from off Cuba. Perhaps *Fierasfer lumbricoides* represents a fourth species (see note).

1. **Disparichthys fluviatilis** Herre (Fig. 89, p. 456)

Disparichthys fluviatilis Herre, Field Mus. Nat. Hist. Zool. Ser. XVIII, N° 12, 1935, p. 383 — ibid. XXI, 1936, p. 436.

The depth is more than 70, the head more than 28 in length; as the tail is broken the fish is more slender than the measurements indicate. The snout equals the eye, 3.33 in head. Origin of dorsal about twice the length of the head behind the gill opening. Anal more developed than dorsal. Colour in alcohol yellowish. Length of single specimen known 140 mm. (After Herre, not seen by me).

Habitat: New Guinea (brook at Marienberg, near Sepik River). Apparently in fresh water.

APPENDIX TO THE BLENNOIDEA

Schindleria Giltay

(Giltay, Bull. Mus. Royal d'Hist. Nat. Belgique X, N° 13, 1934, p. 8)

Body much elongate, laterally compressed, without scales or pigmentation, translucent. Mouth moderate, its upper border formed by the premaxillaries. Upper and lower jaws with 2 or 3 rows of small pointed teeth. Gill opening extending upwards to the level of the middle of the base of the pectorals. Four pairs of gill arches, the two median ones only bearing gills. Pseudobranchiae present. Gill rakers on the upper branch of the gill arches. Dorsal posterior, opposite to the anal, their rays corresponding in a metameric way to the neural and haemal spines of the vertebrae. No ventrals. Caudal peduncle elongate. Caudal slightly emarginate, subtruncate. Air bladder without duct. Pronounced sexual dimorphism, the male being smaller than the female, and provided with a genital papilla. Species small.

Distribution. Two species, living pelagically in sea, from Hawaii and New Guinea.

1. **Schindleria praematura** (Schindler)

Hemirhamphus praematurus Schindler, Anz. Akad. Wiss. Wien LXVII, 1930, p. 79. — Bull. B. P. Bishop Mus. XCVII, 1932, p. 5.
Schindleria praematura Giltay, Bull. Mus. Royal Hist. Nat. Belgique X, N° 13, p. 9.

D. 16-20. A. 11-13. P. 15-17.

Height of females about 14-15, 15-16 in length with caudal; of males 15-17, 16-18 in length with caudal. Head of females 8.4-9.2, 9-9.7 in length with caudal; in males 7.6-8.1, 8.2-8.5 in length with caudal. Eye about 3-4. Pre-anal vertebrae in females 24-25, in males 22-24. Post-anal vertebrae 11-14 in both sexes. Urogenital papilla of male well developed. The anal begins immediately behind the urogenital opening, its middle rays longest. Origin of dorsal before that of anal. Teeth conical, single pointed, most of them somewhat hook-shaped, curved backward, in 2-3 rows in both jaws. Similar teeth on the dorsal and ventral walls of the pharynx. The entire body is unpigmented, clear as glass when freshly caught. A small dark brown to black spot in the level of the 16th or 17th vertebra, caused by pigment on the caudo-dorsal part of the air bladder. Length of females 22.5 mm, of males 18 mm. (After Schindler and Giltay, not seen by me).

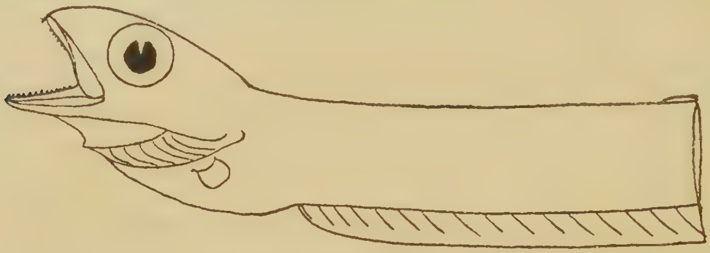

Fig. 89. *Disparichthys fluviatilis* Herre. × 5. After Herre.

Habitat: New Guinea (Manokwari). — Hawaii.
Pelagic, in sea.

Note. The systematic position of this genus is not clear. Schindler considered the two species as being mature larval *Hemirhamphus*, but Giltay compared them with the known young stages of lastnamed genus and pointed out that this is very improbable. Giltay provisionally placed *Schindleria* among the Blennoidea as the sole genus of the family Schindleriidae. I am not convinced that they have found there definitive niche here, but as I cannot make another suggestion, I insert *Schindleria* here as an appendix to the Blennoidea.

ADDENDA AND CORRIGENDA

p. 15. 1. *Parapercis quadrispinosa* (M. Web.), read: 1. **Parapercis quadrispinosa** (M. Web.)

p. 51. **Callionymus** Linné, read: 1. **Callionymus** Linné

p. 80. **Dactylopus dactylopus** (C. V.), read: 1. **Dactylopus dactylopus** (C. V.)

p. 83. **Kurtus indicus** Bl., read: 1. **Kurtus indicus** Bl.

p. 116. *margaritaceous* read: *margaritiferus*

p. 182. Bottom of page, add: Habitat: Batu Islands, Flores, Timor, Batjan, Ambon, Ceram, Sulu Islands. — Riu Kiu Islands, Hawaii.

p. 186. 1. **Naso thynnoides** (C. V.), read: 12. **Naso thynnoides** (C. V.)

p. 188. **Lepidopus** Guan, read: 1. **Lepidopus** Guan

p. 266. 13th synonym: *Alticus saltatarius,* read: *Alticus saltatorius*

p. 290. *Salarias chrysospilus,* read: *Salarias chrysospilos*

p. 316. 17th line from below: "15 filaments to each, cirrus" read: "15 filaments to each cirrus"

p. 415. 2nd line from below: *longiceps* read: *longipes*

In volume VI:

p. 192 add to Key:

C. Dorsal spines rudimentary, excepting the last one. Ventrals wanting in adults . . . . . 7. *Parastromateus*

7. **Parastromateus** Bleeker

(Bleeker, Ned. Tijdschr. Dierk. II, 1865, p. 174)

Apolectus Cuvier & Valenciennes, Hist. Nat. Poissons VIII, 1831, p. 439 (preoccupied).
Formio McCulloch, Mem. Austr. Mus. V, 1929, p. 193.

Body strongly compressed, rhombic. Dorsal and ventral profile angular. Scales small but conspicuous. Lateral line gently curved, straight on caudal peduncle, where the scales are weakly armed with scutes. Mouth moderate, oblique, scarcely protractile. Head partly scaled, its rostronuchal countour keeled. Teeth in the jaws disappearing with age. No teeth on palate. Adipose eyelid feebly developed. First dorsal with about IV hidden spines in front and I well developed one. Soft dorsal and anal similar, the anterior rays much longer than the posterior ones, the upper edges of the fin concave. No finlets behind dorsal or anal. Pectorals long, falcate. Ventrals developed in young, but absent in adults. Caudal forked.

Distribution that of the single species known.

Note. Although our intention was to place this genus among the Stromatoidea (see Vol. VI, p. 191, footnote) I now come to the conclusion, that in face of the evidence given by Tate Regan and other authors, this opinion cannot be maintained.

1. **Parastromateus niger** (Bl.)

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Stromateus niger Bloch Schneider, ibid. p. 492.
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Apolectus niger Jordan & Richardson, Mem. Carnegie Mus. IV, N° 4, 1909, p. 179.
Apolectus niger Jordan, Tanaka & Snyder, Journ. Coll. Sc. Univ. Tokyo XXXIII, Art. 1. 1915, p. 135.
Apolectus niger Barnard, Ann. S. Afric. Mus. XXI, 1925-1927, p. 565.
Stromateus niger Vinciguerra, Ann. Mus. Civ. Genova (3) X, 1926, p. 593.
Apolectus niger Wu, Contr. Biol. Lab. Sc. Soc. China V, N° 4, 1929, p. 89.
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Formio niger Fowler, Hongkong Naturalist II, 1931, p. 293. — Proc. Acad. Nat. Sc. Philadelphia LXXXVI, 1934, p. 453.
Parastromateus niger Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXXVII, 1935-1936, p 142, p. 381.
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D. IV + I. 41-46 (47). A. II. 35-40. P. 23-24. Ll. about 100.

Height 1.5-1.8, 1.9-2.4 in length with caudal. Head 2.9-3.4, 3.6-4.4 in length with caudal. Eye with a very narrow adipose eyelid, 3.8-4.3, 1.1-1.3 in snout, and 1.2-1.5 in very convex keeled interorbital space. Mouth somewhat oblique. Maxillary reaching to below frontborder of eye. Teeth in the jaws slender, pointed, needle-like, inserted on a ridge, almost absent in adults. Opercular bones smooth, with deciduous small scales. The non rudimentary dorsal spine equal to snout and half eye. Dorsal rays much increasing in length to the fifth, which is as long as the eye, decreasing again in length to the 20th, the edge of this part of the fin being concave. The 20th ray as long as snout, following ones slightly decreasing in length, the last slightly less than eye. First anal spine about equal to snout, second one with an articulated, but unbranched flexible upper part, nearly as long as anterior rays, which are longer than head. Following rays rapidly decreasing in length to the 15th, the edge of this part of the fin concave. From the 15th, which is as long as snout, the fin decreases slightly in height, the last one equal to eye. Pectorals about the length of the postorbital part of head longer than head. Ventrals well developed in young, wanting in adults. Caudal deeply forked, its base narrow, the least depth of the caudal peduncle being equal to eye. Colour of preserved specimens brown above, whitish with a silvery hue below. Anterior part of dorsal and especially of anal bluish grey. Fins otherwise yellowish. Length 600 mm.

Nomen indig. Bawal hitam (Malay).

Habitat: Singapore; Sumatra (Benkulen, Priaman, Bajan Si Api Api, Padang); Banka; Java (Jacarta, Japara, Cheribon!, Samarang, Surabaya, Pasuruan); Madura; Borneo (Sarawak); Celebes (Makassar). — Coast of Natal, Zanzibar, Iranian Gulf, Coasts of India, Siam, Andamans, Malay Peninsula, Indochina, China, Japan, Riu Kiu Islands, Formosa, Philippines.

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[1] In naming a fish the Malay people use as a rule "ikan" = fish before the special name. In most cases we have omitted "ikan".

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